SCIENTIFIC AMERICAN

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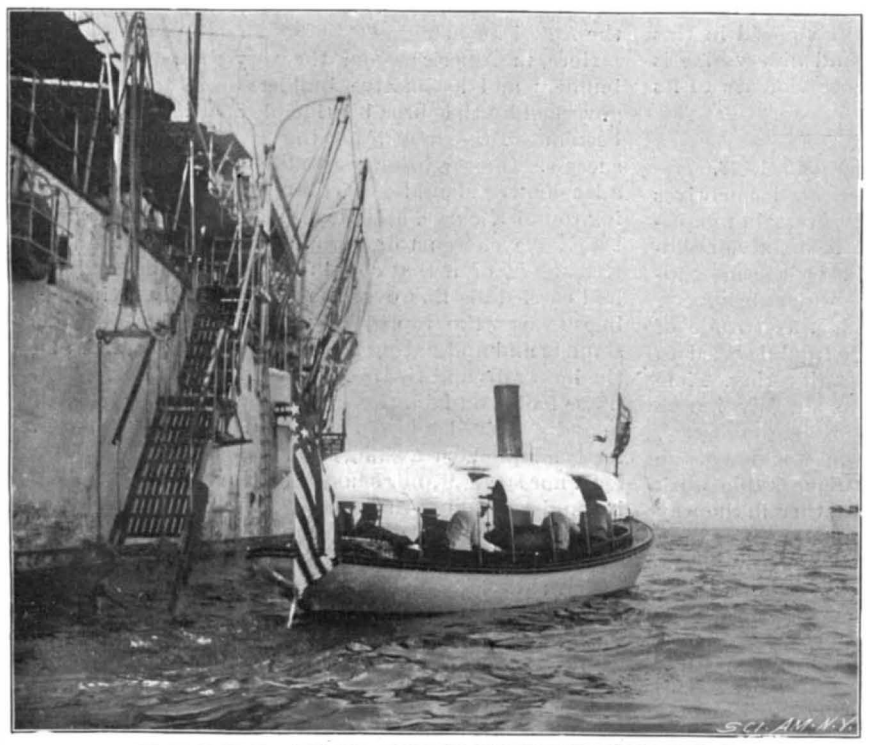
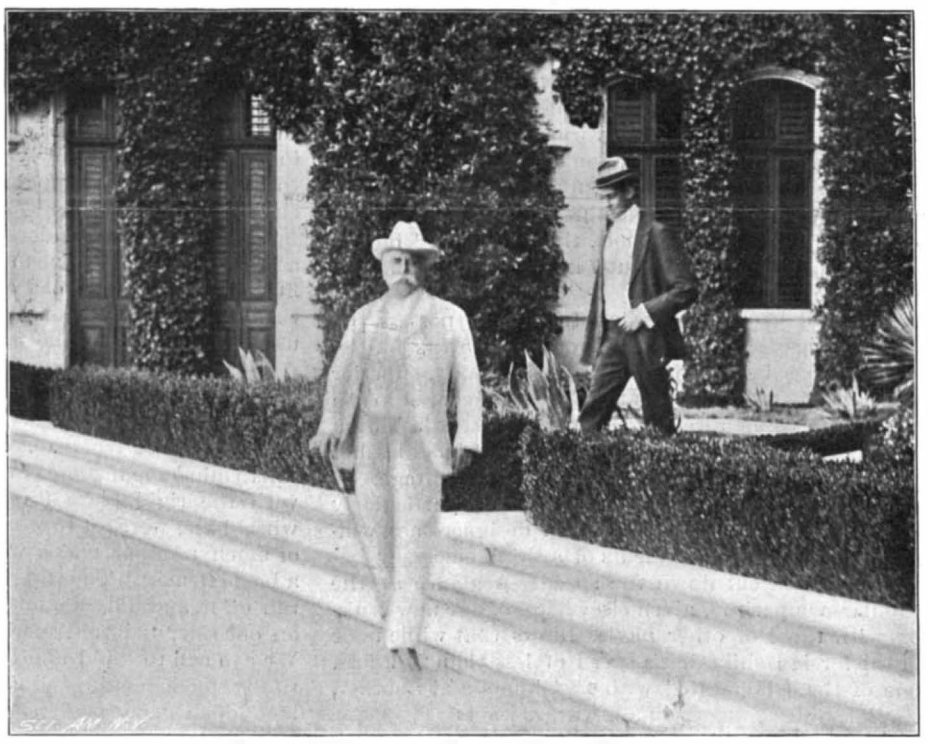


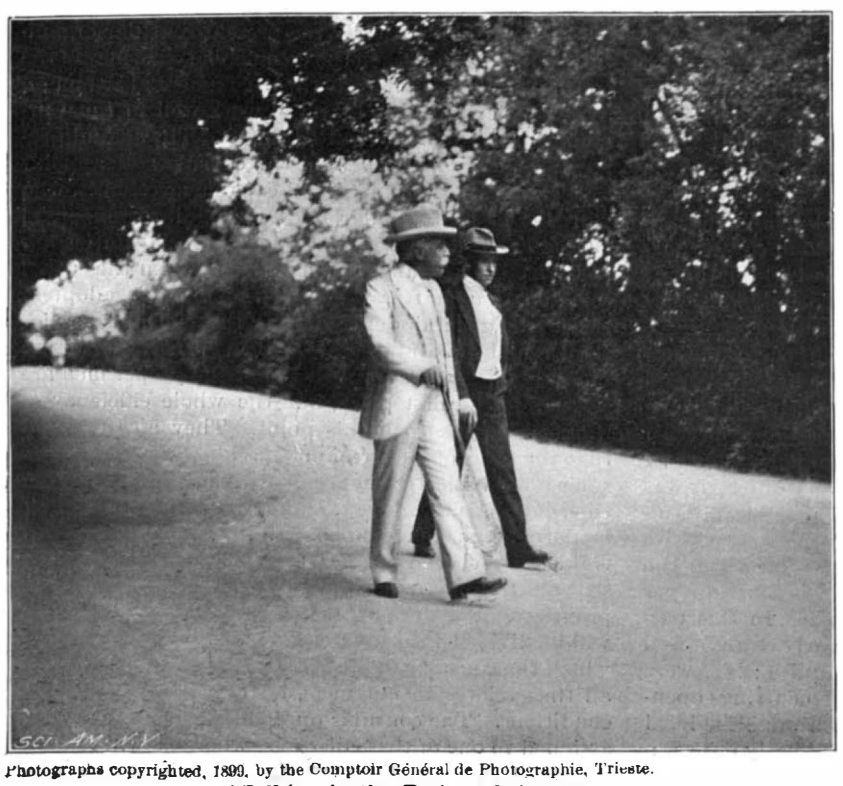
United States Minister Harris Leaving the "Olympia."

Admiral Dewey, Capt. Lamberton, and Lieut. Brumby Paying Official Visits.

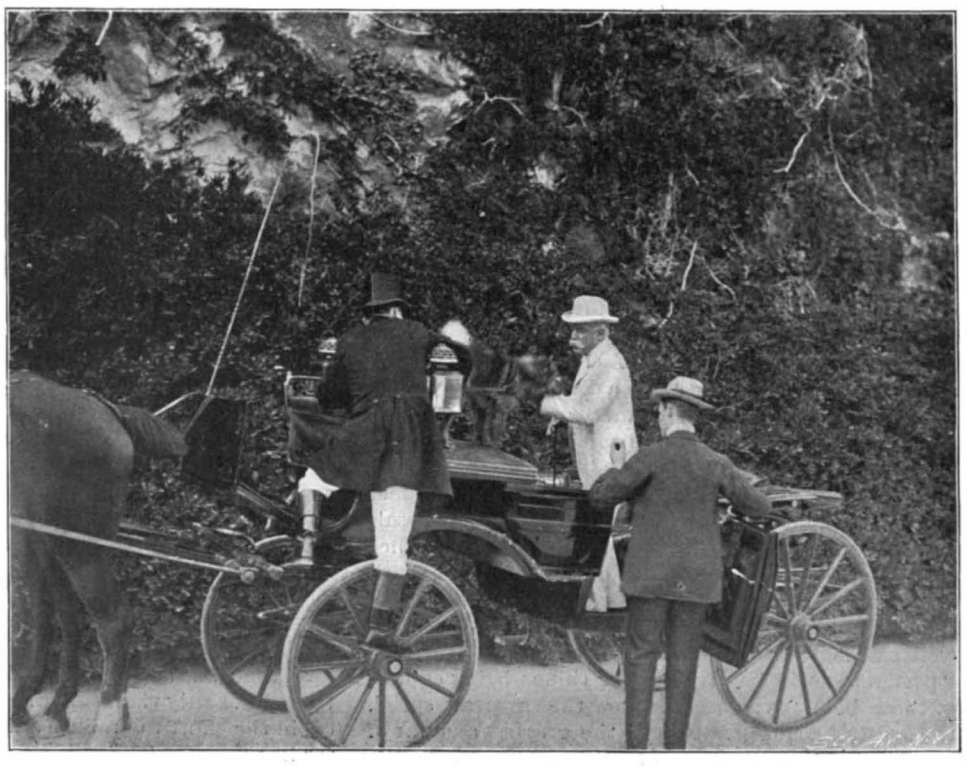
Admiral Dewey Leaving the "Olympia."



Admiral Dewey at the Castle of Miramar.



Walking in the Park at Miramar.



A Ride in the Park at Miramar.

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ADMIRAL DEWEY AT TRIESTE, AUSTRIA.—[See page 121.]

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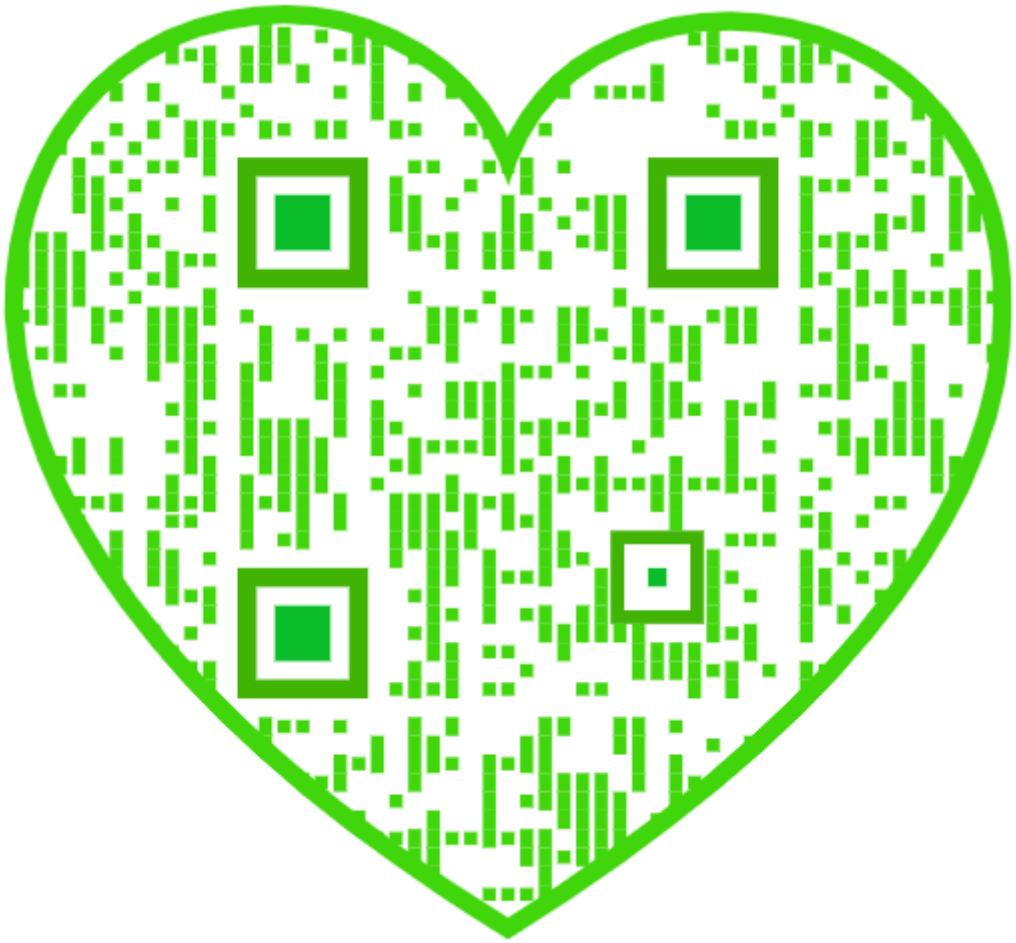

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NEW YORK, SATURDAY, AUGUST 19, 1899.

OUR SHIPBUILDERS AND THE PROPOSED NEW CRUISERS.

Among the more important lessons of the late Spanish war are the supreme value to a warship of a powerful battery, of high speed, and large coal supply. The United States navy needed no admonition with regard to its batteries, for its policy has ever been to mount upon the decks of its ships every gun that they could conveniently carry. With regard to speed and coal supply, however, there was room for improvement, and one of the first effects of the war was to produce a demand for a higher speed than 16 knots in the three battleships of the "Maine" class, whose construction had only recently been authorized.

The events of the war showed that it is scarcely possible to attach too much importance to the question of speed in warships. It was the good average sea-speed of the "Oregon" that enabled her to make her rapid run around Cape Horn and be in at the death of Cervera's squadron, and it was the fine condition of her engines and boilers that enabled her to overtake the "Cristobal Colon" and force her surrender. On the other hand, had the motive power of the Spanish fleet been in good condition and the boats capable of their proper speed of 18 or 19 knots instead of the 10 knots at which the majority made the run, it is possible that all of them, except the torpedo boat destroyers, would have run through the zone of our fire in time to escape without mortal injury, for it is a fact that the highest average speed of the pursuing ships during the chase was only about 13 knots, the "Indiana" indeed being capable of only about 7 knots an hour and the "Iowa" a few knots more.

In the days of the sailing frigate, to possess the "weather gage" of the enemy was to have the battle, other things being equal, half won; to-day, superior speed gives a similar advantage, for the faster ship can accept or decline an engagement, and when in action she can choose the fighting position which enables her to bring her battery to bear to the best advantage. So clearly are these advantages recognized, particularly with respect to cruisers, that naval designers are willing to sacrifice other elements of a ship's efficiency before they will cut down the speed. A glance at the tabular comparison, given elsewhere, of our new cruisers with those of other navies shows that while none of the foreign ships has a speed of less than 20 knots, one of them is credited with 22·4 knots and another, the latest design of them all, with 25 knots.

Our Naval Board of Construction, we greatly regret to see, has produced a design for the six new cruisers recently authorized, which is possessed of two exceedingly grave faults, as we have clearly shown on another page of this issue. Although these vessels are to carry a battery of normal strength, they are to be practically of the obsolete unprotected type, and they are to have a speed of only 16½ knots, which is from 3½ to 8½ knots less than that of the fully protected cruisers of the same size which are under construction or already completed for foreign navies.

We do not hesitate to say that these designs are the least attractive that have ever been produced by the department, and are altogether unworthy of a bureau which has turned out such efficient ships as the "New York" and the new "Maine." As compared with these ships, the proposed cruisers are a distinct retrogression, and in the interests of the country and for the reputation of the department, it is sincerely to be hoped that the ships, as designed, will never be built.

Fortunately, there is a loophole of escape in the fact that shipbuilders will be allowed to make proposals for the construction of the ships, either in accordance with the plans as so laid down, or in accordance with plans and specifications submitted by themselves; and there is a suggestion that the department is not very well satisfied with its own design in the fact that "preference will be given, other things being equal," to those bids "which guarantee the greatest speed, the greatest coal capacity, and the greatest amount of hull protection in the form of a protected deck."

Here then is a splendid opportunity for our private shipbuilding firms to show what advance they can make upon the best work of foreign designers in producing an up-to-date cruiser of 3,500 tons full load displacement on a maximum full-load draught of 16 feet 8 inches. We are fully satisfied that working under these conditions such firms as the Union Iron Works, Newport News and the Cramps will be able to produce a high-speed protected cruiser which will embody all the essential elements of the class and be at least the equal, if not the superior, of any of the fine ships enumerated in the comparison given elsewhere in this issue. In any case, whether the designs of the contractors are accepted or not, the department's designs as they now stand must never be built. The idea of the United States navy entering upon the construction of six unprotected cruisers of 16½ knots speed in this year of our Lord eighteen hundred and ninety-nine is simply preposterous and certainly does violence to its brilliant traditions.

ENGLISH AND AMERICAN LOCOMOTIVES.

The present importation of American locomotives for use on leading English railroads is certain to exercise a far-reaching influence on the locomotive-building industry of Great Britain. Decidedly the most interesting phase of the controversy which has been awakened by this significant event is the attitude of The Engineer, the leading English journal devoted to the interest of civil and mechanical engineering. Time was when this journal was wont to steadily ignore criticism of English engineering work and practice, particularly if it happened to come from this side of the water, and the publication of any remarkable work performed by American locomotives either in the way of hauling heavy loads, or the accomplishment of high speeds in passenger service, was sufficient to bring forth an indignant and clumsily facetious repudiation of these performances, and a cumbersome demonstration of their impossibility on general theoretical principles. Of late, however, The Engineer has shown that it has taken a broader outlook upon the situation, not merely as regards the locomotive industry, but the engineering trade in general. This is particularly noticeable in a recent editorial, which was provoked by letters from two correspondents of the The Engineer who happened to live at opposite corners of the earth, one of whom makes a series of sweeping condemnations of the English-built locomotive because of its utter unfitness to run over the uneven and curved tracks which are found in the colonies and newly developed countries, while the other attempts to make an entire rebuttal of the charges so laid down.

The Engineer fully indorses the criticisms of the average English-made engine in respect of its rigidity and unfitness for pioneer railroad work. "From various parts of the world," says our contemporary, "statements reach us to the effect that the comparatively roughly made American engine is a more satisfactory machine than its beautifully finished English or Scotch made brother. We see no reason why such statements should be made if they are not true. . . . We may say that we can call to mind one instance in which six-wheeled engines, with the rigid plate frames and comparatively long wheel base, were set to work against American engines of much rougher make, with four wheels coupled and a bogie (truck). The English engines burst the road, ran off it, and did such mischief that they were thrown on one side, and the American engines did all the work. We can call to mind another case, in which two beautifully made engines, built to special design for the 5 foot 3 inch gage, made such havoc with a very bad road that they had to be practically rebuilt, the wheel base shortened and the axle-boxes cut away to give side play, before they could be used. . . . We need scarcely say that it affords us no particular pleasure to write thus; but, on the other hand, we have the best interests of the locomotive builders of this country at heart, and we should wholly fail in our duty if we said pleasant things and maintained that the typical English locomotive must be the best for Australia, or South America, or China, or Africa, just because it is the best for the railways of the United Kingdom."

While it is rather late in the day for our contemporary to have made this discovery, it is certain that if the English builders do not wish to entirely lose their trade in the colonies and more recently settled countries, they will have to adopt the American type of locomotive, with its flexible wheel base and general handiness and accessibility to parts. The typical English and American locomotives are the outgrowth of the respective conditions under which the great railroad systems of each country were built up. At the very outset it was realized in America that it was not possible, nor, indeed, desirable, to build our railroads on the expensive lines adopted by the English engineers, of which the Great Western Railway, which cost a fabulous sum per mile to construct, is a notable example. In this particular case the line was made as nearly straight and level as means and money could accomplish; hills were tunneled, costly viaducts built and deep cuttings opened, in the effort to produce a line which would be ideal for its purpose. The rails were, for that early date, unusually heavy, and the roadbed of first-class construction. With this solid, smooth, and straight roadbed there was no necessity for giving much flexibility to the engines that ran upon it, and hence, in the early English locomotives, there was practically no provision for sideplay and easement in running around curves or surmounting vertical irregularities. English track has always continued to be of first-class construction, and although heavier curvature has been adopted in building some of the later roads, there is nothing in that country to compare with the mountain lines which exist in America and in many of the English colonies.

While it is true that the swinging truck has been adopted on many of the English roads, it still appears to be a fact that the typical English locomotive is lacking in the flexibility which is so excellent a feature of the American machine.

Here, in America, from the very first, our railroad builders and locomotive builders seem to have been governed by that broad principle of utility which has been one of the great if not the greatest secret of our success. Our engineers were able to see no reason why a locomotive should not climb a hill and go swinging round a curve, and hence in laying out our lines they have chosen to go around a hill rather than cut through it, or if that could not be done, the engineer had carried his line over the hill, skillfully laying his lines to suit the topography of the land. When his sinuous and undulating roadbed had been graded, and the light rails and ties necessitated by a not overloaded purse had been laid, the mechanical engineer stepped in and produced a locomotive and cars that were perfectly adapted to traveling upon a track that was neither level nor straight, nor smooth in its running. Swiveling and swinging trucks enabled our rolling stock to negotiate the curves, while equalizing levers served to smooth the vertical irregularities of the track. It was easier, cheaper, and obviously the more common sense policy to accommodate the locomotive to the track rather than the track to the locomotive.

THE EDUCATION OF GERMAN CONSULS.

All attentive readers of current newspaper discussion in Germany have noticed the earnestness and intelligence with which the leading journals have seconded the plans which are now understood to be under consideration by the Imperial government for the reorganization of its consular service. The reforms have been dictated by the new and enlarged functions which are imposed upon the foreign service of Germany by the expansion of her foreign trade and by the valiant fight which this country is preparing to make for a permanent place in all foreign markets. While Germany was an agricultural state without colonies or any large export trade, her consular service organized on the old lines served satisfactorily for the protection of German subjects residing abroad, and such other incidental duties as was required of it. Under that system consuls who were educated as lawyers and diplomats underwent a period of training in the Foreign Office and became typical Prussian officials with a good command of languages, a fair knowledge of diplomacy, national law, and the history of treaties, but no practical acquaintance whatever with industrial processes, commercial values, or mercantile usages. These German officials, as it is now stated by the German press, even evinced a certain contempt for trade and those engaged in it and rejected requests for commercial aid and information as forming no part of their official duties. The last ten years have created a demand for a radical reform of the whole consular system, stimulated, it is broadly hinted, by the recognized efficiency of American and other consuls in obtaining valuable information and promoting export trade.

There are two propositions now under consideration. First, to retain practically the present consular organization and to strengthen the commercial efficiency of the consulates by assigning to them commercial attaches, a plan which has been found to work well in the German consulates in the United States. The second proposition is to abolish permanent consuls and appoint in their stead experienced and capable merchants, who will give to the consular office a definite commercial character, while its legal and purely official duties are performed by young attachés trained in the usual manner. No matter which of the plans is adopted, there is a general demand that the consular service shall remain, as now, a life career. In this they are undoubtedly correct provided that the proper men are selected in the first place, but the whole efficiency of the service rests upon this point. They also demand that the basis of its personnel shall be a corps of consular pupils selected by competitive examination for their intelligence, energy, and efficiency as students of modern languages, commercial law, and technology, trained by special studies for their career and then sent out to foreign parts to begin their life work as apprentices. For the purpose of this service the world will be divided into four or five districts, for each of which the consular pupil will be specially educated in all that relates to language, history, and commercial conditions. The consular pupil once prepared will be assigned to one of these districts, where he will remain during his career, thus saving the reckless waste of valuable knowledge and experience which occurs

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where a competent consular officer familiar with the languages and commercial uses of one foreign country is suddenly transferred to another, an evil under which Germany has long suffered.

The new German system will be a step farther on than any which has been taken by any other government, and the immense advantages of such a system are patent to all and the results will be immediate and lasting. The bureaucratic system of consular administration has been carried to its extreme limit by Germany, and now the government appears to have learned that the higher and more valuable work of the consuls requires special attainments and capabilities, not only in different countries, but even in different districts of the same country. Germany has set herself the task of remaining what she has become—one of the foremost manufacturing and exporting nations in the world. What she lacks in native materials and resources she will make up for by superior education, organization, energy and mastery of details, and in the furtherance of this policy every energy of the government and people, from the Emperor to the factory operative, will be enlisted and exerted with a persistent, unswerving patriotic purpose. The consular service is to be made, like her great subsidized steamship lines, the effective agent of the government for pushing the trade of German merchants into every corner of the civilized world; and our very efficient Consul-General at Berlin, the Hon. Frank H. Mason, considers that it will be organized, trained and equipped for this work with the same scientific thoroughness that characterizes the military, industrial and educational systems of Germany. As has already happened in law, medicine, engineering—in nearly every field of applied science—the day of the all-round man with a smattering of many things, but a thorough knowledge of nothing, is definitely past, and the success of the future will be won by the nations as well as by individuals who can bring the highest attainments, the largest experience, and the most consummate proficiency to bear where competition is keenest and the richest prizes are to be won.

PAWNBROKING.

A large part of a recent Bulletin of the Department of Labor is given to a report on pawnbroking in Europe and in the United States, by Dr. W. R. Patterson, of Iowa University. The facts obtained by Dr. Patterson are most interesting, although the precise origin of the pawnbroking business is still shrouded in obscurity. He is disposed to conclude that the banker of to-day is a descendant of the old pawnbroker rather than that the pawnbroker of to-day has derived his business from the ancient banker. In Holland the pawnbroking trade can be traced to 1534, when a pawn bank was set up by a Flemish priest at Ypres. Holland adopted a system in 1614, and France appears to have done so in the same year. It was not until 1591 that a pawn bank was established in Germany, although it is believed that an experiment was made as far back as 1198.

In the Continental countries generally, the government has undertaken the pawnbroking business for the benefit of the poor. This was doubtless in pursuance of the general governmental policy of suppressing the Jews, who had been for so many centuries the moneylenders of Europe and against whom charges of merciless usury and distraint had always been outstanding. This seems to account in some degree for the religious tinge given to the pawnbroking business wherever a Continental government has gone into it. The idea of saving the poor from oppressive interest-rates has caused some ventures to take the form of a gratuitous loan system; but as the theory has grown that the pawnbroking industry had a business side quite as important as its charitable side, and that its successful conduct and permanent usefulness depend upon its being on a self-supporting basis, the laws affecting it have been constantly liberalized to keep pace with the progress of the times. In Belgium, the interest varies from 4 to 16 per cent a year; in Holland, from 5 to 18 per cent; in Germany, the maximum rate is 2 per cent a month for sums of $7.50 or less and 1 per cent on all larger sums. In France the maximum rate was reduced to 6 per cent in 1887, with a fixed charge of one per cent on the sum loaned.

England, like the United States, has steered clear of governmental participation in the pawnbroking business. King Richard I. fixed the rate at 10 per cent in 1199; the Jewish brokers continued to charge from 45 to 65 per cent, so that they were expelled in 1290. The Lombards, who succeeded them, do not appear to have been much better and were driven out in 1530. Several sovereigns, including James I., Charles II., William III., and George I., tried various plans for regulating the trade. Laws have been finally framed which surround the trade with such restraints that the poor are protected.

In the United States the general tendency has been to leave pawnbroking as free as any other business, so that it does not become in any way an abettor of crime. Pawnbroking flourishes only in an urban district and in general in a rather congested locality. License fees and bonds are general, and the interest charges vary greatly in the different States. In Maine pawnbrokers can charge only 6 per cent a year on loans of $25 or more; while in one county of Virginia the interest may be as high as 10 per cent a month. In some of the States the sale of unredeemed pledges is required to be by public auction, and the laws which protect both the pawnbroker and his clients are legion. In Boston there is the greatest measure of police control. Pawnshops are in charge of some thirty detectives, five or six of them visiting each broker daily, and at least two-thirds of the robbers arrested in Boston were tracked by the pawnshops. There are laws in some States governing the articles which may be accepted in pawn, but usually the city ordinances adjust this matter. As a general thing it seems to be assumed that the pawnbrokers are quite an honest lot of men; even their patrons show a great deal of confidence in them, and where the population is settled, as in Philadelphia, it is not uncommon for regular pledgers to leave articles without taking any receipt, and in Providence the tickets are often left with the broker for safe keeping. Although the government does not go into pawnbroking in this country and every reasonable encouragement is given to pawnbrokers, there are a few privately capitalized corporations and societies having a benevolent aim in view, and the maintenance of them unquestionably acts as a check upon the rapacity of some of the brokers who are in the business for gain alone.

SAVING IN ISOLATED PLANTS.

BY ALTAN D. ADAMS.

Isolated electric plants are those devoted to the lighting of individual buildings, manufacturing plants, and institutions, as opposed to general public service. The electric machinery for isolated plants is usually located on the premises to be lighted, and driven from some previously existing source of power, or by an engine or water-wheel especially installed for the purpose. The cost of power per horse power hour delivered to the dynamo will vary with a variety of circumstances, but may be taken to range between 0·8 cent and 3·33 cents per horse power hour in nearly all cases.

Taking a suitable cost of power for any given case, the cost of electric light may be found when the charges for interest on first cost of electric equipment, its depreciation, the amount for lamp renewals and attendance are known. Basing estimates on the use of fifty-watt, sixteen candle power incandescent lamps, the following named prices are very nearly correct: First-class makes of dynamos may be had in medium and large sizes at about twenty dollars per kilowatt capacity, which amounts to one dollar per lamp capacity, since $1000 \div 50 = 20$, which number of fifty-watt lamps can be operated per kilowatt of electric energy supplied. The cost of electric wiring and fittings is not quite so uniform as that of dynamos, but varies with the quality and style of fittings and the kind of building in which they are used.

In factory, warehouse, and other buildings where the electric wires may be erected in plain sight on porcelain supports, the average cost of all electric wires and fittings from the dynamos to but not including the lamps may be fairly taken at $2 per lamp. In office buildings and other places where the electric wires are drawn into iron or other conduits, the average cost of all electric wirings and fittings will be about $4 per lamp. Neither of above estimates is intended to cover the cost of the expensive brass fixtures sometimes used for electric lamps as well as gas, but the figures for open work include flexible electric cords for drop lamps, and the price for conduit work includes plain iron pipe fixtures for the support of lamps.

If ornamental fixtures are desired for the support of lamps, they may be had at a variety of prices, but their cost can hardly be included in the necessary cost of an electric plant. The engineer who has charge of the power plant usually gives the necessary attention to the electric equipment without additional compensation, but an average allowance of 0·01 cent per lamp hour may be made to cover extra services in all cases.

Depreciation and repairs, including the cost of oil and waste, may be safely taken at 10 per cent per year on the cost of dynamos, and an annual interest charge of 5 per cent should be made on the same cost. On cost of wiring, the repairs and depreciation will be covered by 5 per cent, and the interest by another 5 per cent per annum, making a total of 10 per cent. Incandescent lamps at the market price of twenty cents each, and burning four hundred hours on the average, which is hardly more than one-half the time they are frequently kept in use, cost $20 \div 400 = 0{\cdot}05$ cent per lamp hour. Taking as the average cost of one horse power per hour the mean of the maximum and minimum rates of 0·8 cent and 3·33 cents, above stated, the average rate becomes $(0{\cdot}8 + 3{\cdot}33) \div 2 = 2{\cdot}06$ cents per horse power hour. Now, as one horse power is equivalent to 746 watts, it will operate $746 \div 50 = 14{\cdot}92$ fifty-watt lamps, so that the cost of power will be $2{\cdot}06 \div 14{\cdot}92 = 0{\cdot}138$ cent per lamp hour. Since, however, the average dynamo of medium size will only deliver as electric energy about nine-tenths of the mechanical power supplied to it, the actual cost of power per lamp hour will be $0{\cdot}138 \div 0{\cdot}9 = 0{\cdot}153$ cent.

The interest, depreciation, and repair charge on dynamos being $0{\cdot}10 + 0{\cdot}05 = 0{\cdot}15$, or 15 per cent per annum, and the first cost $1 per lamp capacity, these charges amount to $100 \times 0{\cdot}15 = 15$ cents per year per lamp capacity; and on the basis of three thousand hours per year, or ten hours per day for three hundred days, the expense for interest, depreciation, and repairs is $15 \div 3000 = 0{\cdot}005$ cent per lamp hour.

On the exposed class of wiring at $2 per lamp, interest, depreciation, and repairs, at 10 per cent, amount to $200 \times 0{\cdot}1 = 20$ cents per lamp capacity per year, or $20 \div 300 = 0{\cdot}006$ cent per lamp hour. In case of the wiring in conduits at $4 per lamp, the yearly charge is $400 \times 0{\cdot}1 = 40$ cents per lamp capacity per year, or $40 \div 3000 = 0{\cdot}012$ cent per lamp hour. The total cost per lamp hour is the sum of above items, as follows:

Cost of power	0·153 cent per lamp hour.
Cost of lamp renewals	0·050 " " " "
Cost of attendance	0·010 " " " "
Interest, depreciation and repairs on dynamo	0·005 " " " "
Interest, depreciation and repairs on wiring	0·012 " " " "
Total cost to operate fifty-watt lamps	0·230 " " " "

This estimate for the cost of light in isolated electric plants is based on the most expensive style of wiring, and an ample allowance in other directions, so that it is probably higher than the actual cost in many cases, where cheaper power, less lamp renewals, no extra attendance charge, and less expensive wiring and fittings are had. It should be noted that nearly all the above charges occur only in operation of the plant, so that when not in operation the only charge is for interest and a small part of the depreciation named. To compare the cost per lamp hour of electric light from a public supply and from an isolated plant, the interest and depreciation, cost of wiring and fixtures may be omitted from both charges, as they would be the same for each, and the cost of lamps for public supply may be taken as included in the common charge of fifteen cents per thousand watt hour, as this is a usual practice, the supply station furnishing the lamps

At fifteen cents per thousand watt hour, the cost to operate a fifty-watt lamp is found from $(15 \times 50) \div 1{,}000 = 0{\cdot}75$ cent per lamp hour, while deducting the item for wiring in cost above found gives $0{\cdot}230 - 0{\cdot}012 = 0{\cdot}218$ cent per lamp hour as the cost with isolated plant. Dividing the cost per lamp hour with isolated plant by the cost from public supply gives $0{\cdot}218 \div 0{\cdot}75 = 0{\cdot}29$ or 29 per cent, showing the cost of light from the isolated plant to be only 29 per cent of the cost from public supply. Taking gas at $1 per thousand cubic feet, or one mill per foot, the cost for a 5 foot burner, corresponding to a sixteen-candle lamp, is 0·50 cent per hour, or $0{\cdot}5 \div 0{\cdot}23 = 2{\cdot}17$ times the cost of a sixteen-candle fifty-watt incandescent lamp in an isolated plant.

With the cost of electric light in isolated plants at less than one-third that from public supply, and not one-half that of gas, it is no wonder that the increase in the number of these plants has been one of the most marked features of electrical development during the past ten years; but the wonder is that in so many large buildings and institutions sums are still paid for lighting by gas or electric power that often in one year, and in very many cases two years, would cover the complete cost of a complete isolated plant. To prove this last fact, it is only necessary to remember that the cost of first-class electric machinery and wiring is only about $5 per lamp capacity, and then compare this figure with the yearly charge for gas or electricity from the public supply.

Assuming light to be required three thousand hours per year, the charge for electric power per lamp year at three-fourths cent per lamp hour is $0{\cdot}75 \times 3{,}000 = 2{,}250$ cents, or twenty-two and one-half dollars; while with gas at one-half cent per lamp hour, the cost per lamp year is $0{\cdot}5 \times 3{,}000 = 1{,}500$ cents, or fifteen dollars. If lamps burn so little as one thousand hours per year, or three and one-third hours each working day, the yearly outlay for gas is enough, and for electric power one and one-half the amount required for a complete electric equipment. This wide difference in cost between light from isolated plants and public supply is inherent in the circumstances of the two methods and cannot be overcome.

The cost of power to the public supply company is somewhat less, usually, than to an isolated plant, but these companies' fixed charges are enormously greater, and a large part of their capital must be invested in electric circuits between the central station and the consumer, on which there is a heavy charge for interest, depreciation, and repairs per lamp capacity. Isolated plants seem certain to prove in the future, as in the past, one of the most important fields for the application of electrical equipments.

THE shortage of pig iron has been causing some inconvenience, particularly in the West, where some founders have had to shut down, owing to the lack of raw material. It is not thought that the famine will last very long.

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The Large Countries of the Globe and Their Colonies.

M. Paul Barré, secretary of the Société de Propagande Colonial, says L'Illustration, has compiled a list of the colonial possessions of the various powers. Following are the figures which he gives:

	Million Inhabitants.
British Empire	406
Chinese Empire	400
Russian Empire	132·5
France and colonies	97·5
United States and colonies	85·5
England and colonies	61·5
Japan	45
Austria-Hungary	44·5
Holland and colonies	33
Ottoman Empire	25·5
Belgium and the Congo State	23·5
Spain and colonies	18
Brazil	17
Portugal and colonies	13·3
Mexico	11·5

Of the inhabitants of the British Empire, about 40,405,000 are in Europe, 308,300,000 in Asia, 45,000,000 in Africa (including Egypt), 7,100,000 in America, and 5,500,000 in Oceanica.

France has 38,300,000 in Europe, 23,600,000 in Asia, 35,000,000 in Africa, 420,000 in America, and 150,000 in Oceanica.

The following table gives the land area of the countries having about a million or more square miles of surface:

	Square miles.
British Empire	11,969,720
Russian Empire	8,803,536
Chinese Empire	4.324.544
United States and possessions	3.794,015
Brazil	3,228,735
Germany and colonies	1,235,584
Ottoman Empire	1,154,112
Argentine Republic	1,077,274
Portugal and colonies	911,243
Belgium and Congo State	899,273
Holland and colonies	751,775
Mexico	747,914
Persia	635,167
Bolivia	511,222
Colombia	464,502
Peru	438,817
Venezuela	403,109
Spain and colonies	391,139

England occupies the first place in respect to her population and area. She contains a quarter of the human race. A second quarter is Chinese. Almost a third quarter is contained in Russia, France, United States, and Germany. Three-quarters of the population of the globe are therefore governed by only six states.

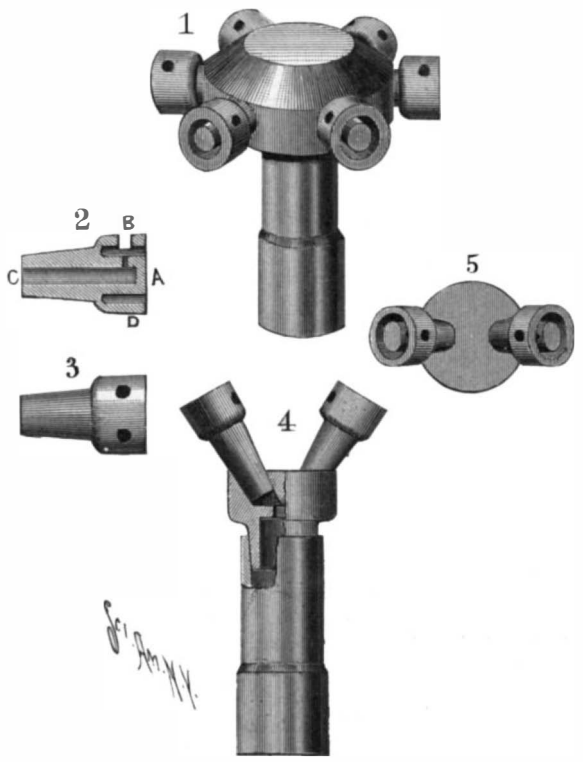
The Anglo-Indian empire contains only 125,489 square miles in Europe, but it has 2,248,476 in Asia, 2,625,616 in Africa, 3,665,823 in America, and 3,299,781 in Oceanica.

France has 206,960 square miles in Europe, 309,668 in Asia, 3,706,752 in Africa (including the zone of French influence), 78,382 in America, and 15,058 in Oceanica.

A NEW ACETYLENE GAS BURNER.

Acetylene gas possesses so many advantages for isolated lighting that it is little wonder the industry is constantly progressing and is now on a sure foundation. One source of trouble which consumers have had with the new illuminant has been that owing to the great richness of the gas it was not possible to provide burners which would consume more than one cubic foot of acetylene gas per hour without smoking and consequent loss of luminosity. This difficulty has been obviated in a new acetylene burner invented by D. M. Steward, of Chattanooga, Tenn., by the grouping of any number of flames on one-burner and by a new air-mixing device. Our engraving shows the construction of the burner. The pillar does not differ from those in general use. At the upper end of this pillar is fitted the head of the burner proper which is made of lava or other similar substance. The burner stems extend from this head and diverge from each other. They are arranged in pairs, and the jet openings in each stem are adapted to direct the jet toward that of the adjacent stem. Each stem is of cylindrical form, and is made slightly tapering with the smaller end fitting into the openings in the head and its larger end surmounted by a burner tip formed by an annular cup-shaped flange, *D*, and extension, *A*, in which the discharge opening is drilled. An opening, *B*, is drilled through the flange opposite the opening from the tube proper, *C*, which conveys the gas to the tip (see Fig. 2). Opening, *B*, in the flange is of larger diameter than that in the center wall of the burner. This flange provides an air space between the extension, *A*, which terminates the end of the gas tube, *C*, and the interior of the flange, so that as the gas is discharged from the opening it will suck the air into the air space, and so provide for uniform admixture of the air with the gas discharged through the aperture in the flange. The air-mixing device is a unique feature of the burner, and is an improvement on all previous burners, the old method being to surround the jet of gas with a number of small inlets or holes for air. In the new burner the cup-shaped cavity provides a sufficient amount of air, and keeps the burner cooler than with any other known construction.

The tips are so arranged that the two jets are directed toward the jet from the adjacent tip, and inwardly in an oblique position. The jets so discharged from each tip commingle with the jets discharged from the adjacent tip on each side so as to form flat flames The head being located between the pillar and



A NEW ACETYLENE GAS BURNER.

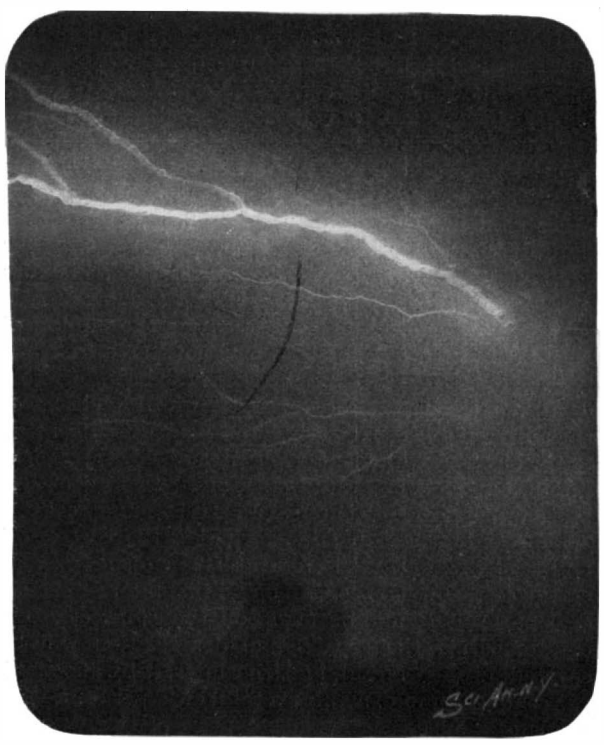
the burner stems, the pillar is kept from becoming heated. The burners are made by the State Line Talc Company, Chattanooga, Tenn.

PECULIAR LIGHTNING FLASHES.

Our illustration is taken from a photograph by Mr. A. E. Small, of Madison, Wis., made in June, 1898, and was sent to us by Mr. Robert M. Long, of Sun Prairie, Wis.

Attention is called to the peculiar ribbon-like appearance of the flash.

An experienced photographer of lightning flashes informs us that this photograph is an excellent example of its kind, and states that the theory is that the lightning, in its passage through the air, is driven by the wind so as to flatten it out, giving it the ribbon effect. This may occur oftener than we are aware of, because if the wind was driving the lightning toward or from the camera, the effect could not be observed. If, however, the wind blows across the field of view,



RIBBON LIGHTNING.

then an opportunity is afforded for getting a picture of this curious kind of a flash.

The tree barely visible at the bottom of the picture shows the flash to have moved in a horizontal direction across the sky.

It is probable the study of photographs of lightning flashes may become as interesting as those on the subject of astronomy. Certainly some remarkable effects can be obtained if the proper advance arrangements are made.

Automobile News.

There will be a parade of automobiles at Newport some time during the present month.

The first automobile club of Germany has just been organized and the Duke of Ratibor is the president.

The United States Express Company will soon have an automobile express wagon for trial in New York city. Horseless vehicles are an ideal means of transporting express matter in large cities.

A show of automobiles is to be held at Dover, England, September 18 to 21, simultaneously with the meeting of the British Association. The object of the show is primarily to provide an interesting display and to benefit the motor car industry.

A New Jersey automobile syndicate has recently increased its capital stock to a considerable amount in order to establish a connecting system between New York and Philadelphia. It is expected that this will be a model working system for other cities.

A recent writer in a New York paper has noted the fact that with the general introduction of automobiles cruelty to animals will almost cease. A driver will no longer be able to exercise his whip, and if he forces his motor unduly he is reasonably certain of a good repair bill.

A plan is on foot to establish an automobile line between New York and Morristown, N. J. The residents of that town object to a trolley line which it is proposed to construct, and it is possible that the traction company will start an automobile line, which will be unobjectionable.

Prince Lobenguela, of Matabeleland, recently had a ride in a horseless carriage. When the vehicle arrived, he inquired after the horses, and first considered it as a "devil machine." Finally he consented to mount and thoroughly enjoyed the ride. At the end of the trip he patted the automobile as though it were a horse.

On July 30, two automobiles beat the Paris-St. Malo express in a race between these cities, which are 226 miles apart, making the best time ever recorded for an automobile. They covered the distance in seven hours and thirty-five minutes. The time of the train was seven hours and forty-eight minutes. It cannot be considered a very fast express train, however.

As already noted, the number of accidents to automobilists in France is constantly increasing, and unfortunately a large number of them cannot be traced to any well-defined cause. The entire motor carriage seems to fail at the wrong time, when going at a high rate of speed. In most instances the carriage has been entirely destroyed and the occupants have only escaped death or serious injury by a mere chance.

The recent automobile exhibition at Paris more than paid expenses, and there is a tidy little balance left to facilitate international contests. The exhibition showed that what was desired by a large number of people was an automobile carriage which should be bigger than a tricycle and which could be sold at a price much less than the large and heavy automobile vehicles. Those which cost about $800 are very popular.

The Automobile, a monthly magazine devoted to the interests of horseless traction, will soon be published in New York city. The business manager of the magazine has just returned from Paris after a close study there during the last two years of everything appertaining to automobile carriage interests, and he has secured the co-operation of competent, expert writers in Europe. The first number of this periodical will be looked for with interest.

Liverpool has had an exhibition of horseless vehicles for heavy traffic. A number of lorries and heavily loaded wagons were set at difficult tasks, even to climbing zigzag gradients and running up hills laid with smooth cobbles. A Bailey & Thornycroft lorrie loaded, stopped and started on a steep gradient. It succeeded in successfully carrying its load of three and a half tons and restarted without skidding. It is the opinion of English experts that if England has been backward as regards motor carriages for pleasure, she is well ahead with vehicles for carrying freight, and that these wagons are destined to play an important part in the transport work for the army.

The automobile and bicycle exhibit at the Paris Exposition will be located in the building, at the Bois de Vincennes, provided for the housing of the railway exhibits of all countries. Ample space has been secured for the American bicycle building. It is located in conjunction with a special bicycle track for showing the wheels in operation. It is evidently expected that American builders will make a larger showing than any other country. A track two miles in length runs around the lake in the park, which will aid in properly showing the automobiles. A space of 4,300 square feet in the automobile building has been secured for American exhibitors. American builders of horseless vehicles are now so numerous and the types which they make are so varied that the display ought to be one which will be highly creditable to this new industry.

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THE STRATFORD TROLLEY CAR DISASTER.

The recent deplorable trolley car accident at the upper part of Stratford, Connecticut, in which twenty-nine people were killed and sixteen were more or less seriously injured, is certainly one of the most shocking disasters in the history of the electric railroads. Speculation has been rife as to the predisposing cause which led to this wholesale loss of life; but the facts that have been brought out at the inquest, coupled with a personal inspection of the site by a representative of the SCIENTIFIC AMERICAN, leave but little doubt in our own mind as to the train of causes which precipitated the disaster.

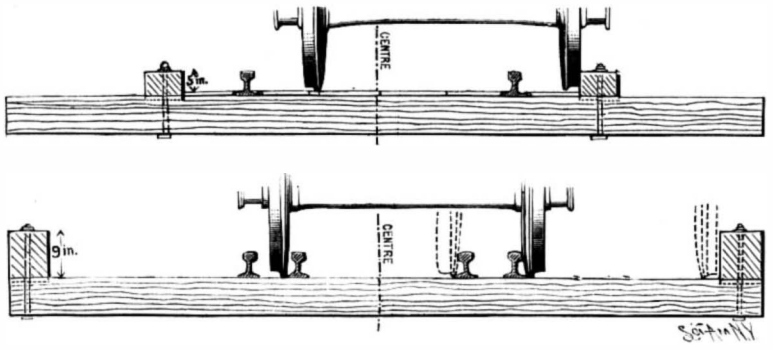
The accident occurred on the afternoon of Sunday, August 6, on the extension of the Bridgeport and Stratford Electric Railway through the north part of Stratford to Shelton, ten miles north, and known as the Shelton Street Railway. The extension runs north from the old road along the highway of the former town for about a mile, and then turns to the left over private property across the site of an old mill-pond, which had been drained during the building of the road. The track crosses the depression in which the pond lies by means of the steel bridge shown in the accompanying illustrations, which was built by the Berlin Iron Bridge Company, and, except in the particulars to which reference is made later in this article, appears to be of the best design and construction. From the point where the track leaves the highway to the bridge is about 700 feet, and the grade descends at the rate of three feet in one hundred until the bridge abutment is reached.

The total length of the bridge is about 400 feet. It is carried on steel piers resting upon masonry foundations. The trusses are of the deck type, and the floor consisted of ties 6 × 8 inches × 14 feet in length, laid on and bolted to the steel trusses and spaced and held in place by two guard-rails of oak measuring 6 × 10 inches, which were notched down over the ties and secured to them by screw bolts. The guard-rails were spaced about 12 inches on the outside of the rails.

The road was entirely new, having been opened for traffic only three days before the accident occurred, and the approach to the bridge appears to have been in a very unfinished condition. This approach for the whole 600 or 700 feet of its length consisted of a sand and gravel fill, upon which the ties had been laid, but no great amount of tamping or surfacing had been done.

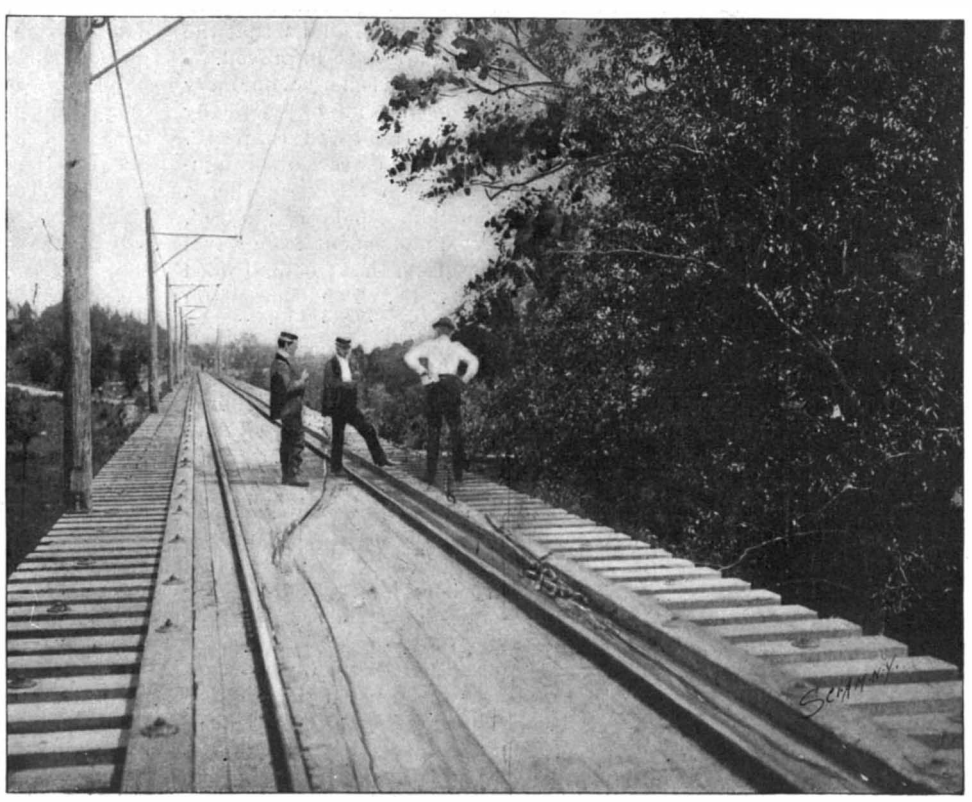
The car was of the four-wheeled, rigid base type, with the axles placed well in toward the center, and long overhangs. It was heavily loaded as it turned out from the highway and started on its fatal trip down the 600 or 700 feet of grade and across the bridge. According to the evidence of the motorman, when he started he turned the controller three notches and did not shut off the current until he was within 100 feet of the bridge. He says that the car was not running fast, or any faster than usual; but it is easy to calculate that the acceleration due to a descent over several hundred feet of a 3 per cent grade, aided by the current due to the controller being one-third open, would result in a speed that was probably between 25 and 30 miles an hour. The rapid movement of the car over a new and practically unballasted track appears to have produced a fore and aft "teetering" of the car—a result which invariably follows when a car of this type with a long body and short wheel-base base passes over an uneven track. This motion was probably greatly aggravated when the forward axle passed from the elastic roadbed to the unyielding abutment, the motorman testifying that it "jolted a little" at this point. It is quite conceivable that the vertical oscillation had reached a point where the load was practically all taken off the forward axle, and under such conditions it would only require a slight sidewise pressure to cause the right-hand wheel to mount the rail.

Now that this was what happened appears probable from the evidence. The motorman stated that he first noticed that something was wrong when he was about 15 feet on the bridge, and the expert engineer who made an examination of the bridge states that the wheel climbed the rail at 10 feet from the abutment. The flange seems to have ridden upon the rail for 30 feet before dropping into the space between the steel rail and the guard-rail. The wheel then ran for 28 feet against the inside of the guard-rail, which it finally mounted, the car continuing to run diagonally upon the ties for another 30 feet until it finally toppled over and fell bottom up a distance of 37 feet to the bed of the mill-pond below. The fearful mortality was largely due to the weight of the heavy motors under the floor with the added weight of the wheels crushing the roof-supporting posts, the victims being thereby imprisoned between the floor of the car and its roof. Our upper illustration shows the car floor intact except the motor opening, while the seats are demolished excepting that in the rear. The car was turned back into the position shown and the dead removed from the spot indicated by the confused mass of debris.



1.—The upper drawing shows bridge floor as built; the lower drawing shows improved floor with both inside and outside guard-rails.

2.—Wrecked car lying beneath the bridge.



3.—Deck view, showing where car left the bridge.

STRATFORD TROLLEY CAR DISASTER.

There are many lessons to be learned from this disaster. In the first place, it is simply courting disaster to allow suburban trolleys to run upon newly laid tracks before they have been properly ballasted, aligned, and surfaced, particularly if the cars are of the long body and short and rigid wheel-base type.

The second lesson is that the style of guard-rail used on this bridge is unable to keep a car on the bridge if it jumps the rails when going at high speed. If wooden ties are used they should be inside and not outside the rails, for we must remember that the tread of the wheel is raised about an inch from the ties by an amount equal to the height of the flange, and if, as in this case, planking is laid on the ties, another inch of height is lost. It is probable that the effective height of the guard-rail was not over 3 inches, for we must subtract one inch for notching down over the ties, one inch for the planking, and one inch for the height of the wheel flange, leaving only 3 of the 6 inches of depth of the guard-rail available.

As a matter of fact, however, good construction demands that a steel rail guard be placed about 5 or 6 inches inside of each main rail. Had such rails been in place on this bridge, when the right-hand wheel dropped over to the right of its rail the left-hand wheel would have had the full height of a 5-inch steel rail to prevent its further movement in a lateral direction across the bridge. If by any chance it had climbed this rail, it would still have had to climb the right-hand steel guard-rail, and with the assistance of an 8 by 10 wooden guard-rail placed on the extreme ends of the ties, as shown in our engraving, the further progress of the car would be arrested.

The tracks of the derailed car are outlined in our lower illustration, which was made from a photograph kindly loaned us by The New York Herald. It will be seen by the track on the right that the face of the right wheel pressed against the edge of the guard-rail with such force that it finally struck a soft or biting spot, which assisted it in mounting the guard-rail.

A floor system constructed on the lines above shown would, in our opinion, be a perfect safeguard against such disasters as that of August 6; but as long as the control of a derailed car is left to a couple of wooden stringers placed on the outside of the rails, the chances of its remaining on the bridge are exceedingly slim.

A School for Motormen.

The Metropolitan Street Railway Company of New York has a regular school for motormen, which is described in a recent number of The Street Railway Review. The men are not given any theoretical instruction, the idea being merely to teach them the practical duties connected with their work. A book of rules is given to each new man, with which he has to acquaint himself, and he is obliged to undergo an oral examination in it. The practical drill, to which considerable time is given, is rendered possible by a room which has fifty controller or brake equipments. The instructor gives bell signals, and the men operate the controllers and brakes according to the signals which they receive. After a thorough practice in controller and brake manipulation, the student is instructed in the clerical work to be required of him and then is placed with a sub instructor on a car for two or three weeks. The company is satisfied that the school gives it better men than they would obtain by immediately handing a raw recruit over to an experienced motorman to be broken in, and considers that it saves them large sums, not only in motor and controller repairs, but also on the accident account. Weekly lectures connected with their employment are also given in the schoolroom, which are free to the employés of the company. They also have the use of a club room, with a library and reading room.

THE Pennsylvania Railroad is now running a train between Washington and Atlantic City, a distance of 206 miles, in four hours and twenty minutes.

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Correspondence.

Tripler's Surplusage.

To the Editor of the Scientific American:

In answer to the criticisms that have appeared in your valuable journal of my theory of Tripler's surplusage, I would beg to say that I now fully admit the fallacy of my first argument, but inasmuch as it appears that I had a wrong conception of Tripler's process, it does not necessarily follow that surplusage itself is an impossibility.

I must again repeat that I am not contending for the possibility of a creation of force when I speak of the possibility of surplusage, but simply insist that by means of liquid air it may be possible that Tripler has discovered a new way of utilizing a natural force. The man who invented the first waterwheel and Tripler may possibly be placed in the same category. It appears now that Tripler produces his surplusage, if he produces it at all, not directly by the heat of the sun, as he originally claimed, but by the pressure of the atmosphere.

I can anticipate the shout of derision that will follow such an apparently unscientific proposition. It will be immediately said that my own original criticism of the impossibility of gaining a surplus by using the heat of the atmosphere to expand when one must again condense against the same heat applies equally against using the pressure of the atmosphere, inasmuch as this pressure can only be utilized by creation of a vacuum, and the creation of this vacuum would cost as much energy as would be gained by its use. With a perfect frictionless machine, and given a vacuum to start with, the force of the air rushing into the receiver would just furnish the energy required to pump out the air and create an equal vacuum in another receiver of same size and in same temperature, etc. However, Tripler does not "pump out" air to form his vacuum, but he "liquefies" part of it and utilizes the pressure of the incoming air, rushing in to replace it, to furnish him the power for the liquefaction.

It may be said that the greatest pressure alone will not liquefy air, and certainly not 15 pounds per square inch, which is all the pressure of the atmosphere will furnish under best conditions. However, we start out with the assumption that the temperature within Tripler's receiver or liquefier has already been reduced to say 290 degrees or more below zero with the liquid air sent into it previously produced in another liquefier by the energy of the steam engine. Now, air liquefies without pressure at —312°, and hence at a temperature approximating —312°, say —290°, it may be considered that a pressure of less than 15 pounds is sufficient for liquefaction. The point now is to determine whether the incoming of fresh air at 70° above zero will tend to increase the temperature within the liquefier more than the liquefaction of part, say one-twentieth, of this fresh air tends to decrease it. The incoming air furnishes a positive energy toward liquefaction by its pressure and a negative energy against liquefaction from its heat. If the positive energy exceeds the negative, then a surplusage is created, and liquid air will be produced free of cost.

H. Gaylord Wilshire.

Los Angeles, July 10, 1899.

FAULTY FEATURES IN OUR PROPOSED SHEATHED AND COPPERED CRUISERS.

By an Act of Congress, approved March 3, 1899, appropriations were made for the construction of six sheathed and coppered cruisers of about 2,500 tons trial displacement. In accordance with the Act, the Board on Construction has recommended the building of six vessels, whose particulars, as given in the accompanying table, show that the new ships are to have a full load displacement of 3,500 tons, that they are to be of the unprotected type, that they are to carry 700 tons of coal, and that the speed is to be 16½ knots.

The only satisfactory method of judging of the merit of a proposed type of warship is to compare it with ships of a similar size and class which represent contemporary practice among the navies of the world.

The displacement of a warship, whether it be 3,500 tons or 15,000 tons, represents the working capital of the naval architect. In designing his vessel, he apportions so much of this weight to armor, so much to armament, so much to motive power, so much to coal, and so forth. If he wishes to increase any particular element, it will be done at the expense of the others. If he uses up his displacement in providing a powerful battery and heavy armor, he must reduce the coal capacity or the speed, or perhaps both, and if the ship, furthermore, is crammed with engines and boilers in the effort to produce phenomenal speed, either the armor or the battery or both must suffer. The ideal warship is that which combines armament, coal endurance, speed, and protection in such well adjusted proportions that she is formidable in all the elements of fighting power without the sacrifice of any essential feature of first-class construction

There is no branch of engineering in which there is less pretense than in warship building. The interests at stake are so vital, involving in some instances—notably in the case of Great Britain—the very existence of the nation, that every country is aiming to produce the very best results under the appropriations that are voted for naval purposes. Designers watch each other closely, and borrow each others' ideas to an extent that has no parallel in other branches of constructive work. Hence, in any such tabular comparison of ships as that which accompanies this article, we can easily and surely detect the general drift of expert opinion as to the best type of ship to meet the present conditions of naval warfare.

We greatly regret to state it as our opinion that, ton for ton, the proposed United States cruisers are the least efficient ships of the whole seven, an opinion which must be shared by any one who makes a careful study of the figures as here laid down. Not only are the new cruisers in proportion to their size greatly inferior to the U. S. S. "Montgomery," a vessel that was designed over ten years ago, but with their lack of a complete protective deck and their low speed they are a positive reversal to the "Atlanta" and "Boston," ships which represent our earliest efforts at steel warship building, made over fifteen years ago.

It is no reply to these objections to point out that the new cruisers are to be sheathed and coppered, and that some of their displacement is due to the extra weight thus involved, for one of the United States cruisers, the "New Orleans," is a sheathed and coppered vessel, and it is only necessary to add from 150 to 200 tons to the displacement of the other vessels to arrive at their actual displacement, if similarly sheathed—an addition which still leaves them a wide margin of superiority over the proposed cruisers.

We will now compare the new cruisers with the other six ships enumerated in the table. The "Montgomery" being a cruiser of the unprotected class—that is, having no protective deck, but merely a thin "watertight" deck—is the ship which naturally suggests itself first for comparison. Her full load displacement is 2,229 tons, or, adding 150 tons for sheathing, say 2,380 tons, which is 1,120 tons less than that of the new ships. Yet, in spite of this disparity, the smaller and older boat has the same battery and 2½ knots higher speed; whereas, on an increase of over 1,100 tons in displacement, the new designs can only show an advantage of 360 tons of coal and 2 inches of steel laid on the slopes of the unprotected deck for a third of the vessel's length amidships. The "Montgomery," moreover, carries two torpedo tubes. The extra speed and the torpedo outfit offset the extra coal carried by the new boats. So that we have about 1,000 tons of displacement unaccounted for, even if we admit that the accommodations for officers and crew are improved.

The comparison with the "New Orleans" of our navy is particularly interesting, as the ships are of practically the same size and both are sheathed and coppered. The "New Orleans" was in active service throughout the war, and on one occasion fairly smothered the Santiago batteries in a single-handed duel; indeed, she has received the highest indorsement from naval officers, and it is with them, surely, that the final word as to a vessel's efficiency must lie. The comparison shows an overwhelming superiority for the "New Orleans," for on about the same displacement she carries 100 tons more coal, she has 3½ knots more speed, she has a complete protective deck with a maximum thickness of 3 inches, she carries three torpedo tubes to none in the new designs and her battery is considerably more powerful. At a cruising speed, she can steam about the same distance as the new boats, she can run away from them or run them down at will, and in a stand-up fight she could deliver a greater energy of fire, while her protective armor would give her an incomparable defensive advantage.

Just here, it will be well to state that the alarmist rumors as to instability of the ship are altogether unfounded. Inquiry of officers in the Construction Department elicits the information that the "New Orleans" was never reported to be unstable, and inquiry of the officer who commanded the ship during the war brings the statement that in a heavy sea off San Juan, when all but empty of coal and ammunition, she showed an apparently ample margin of stability. We touch upon this question in order that the remarkable inferiority of the new designs to a well-tried ship of the same type and size may carry its full and proper weight of conviction.

Of foreign ships, we have selected first the "25 De Mayo," of the Argentine navy. If sheathed and coppered, her displacement would be 3,500 tons, or just that of the proposed cruisers, while the increased weight would reduce the speed to about 22 knots. Here, then, we have a cruiser launched ten years ago, and of the same displacement as our new ships, which is of over 5½ knots greater speed, has a more powerful battery (the two 8·2-inch guns having nothing to match them in the new designs), with six torpedo tubes as against none, and with a complete protective deck 2 inches thick on the flat portions and 4½ inches on the side slopes, as against a strip of 2-inch steel on the slopes for a third of the length amidships. On the other hand, the only point of superiority of the 16½-knot boats is that they carry 700 as against 600 tons of coal.

The next comparison is with the "Puglia," an Italian cruiser which, if sheathed, would displace about 2,800 tons and have a speed of 19¾ knots. On 700 tons less displacement, she carries a somewhat more powerful battery and 50 tons more coal, has a complete 1-inch protective deck and 3¼ knots advantage in speed, besides carrying two torpedo tubes. This is, perhaps, the most striking comparison of all, for it shows that as compared with a boat fully 25 per cent larger than herself, the Italian cruiser, if sheathed, would possess a positive superiority on all points of comparison and an overwhelming superiority in speed and protection.

Japan, on 200 tons less displacement (supposing the "Suma" were sheathed), possesses a vessel with 3¼ knots more speed, a complete protective deck, a slightly less powerful battery, and two torpedo tubes as against none.

Finally, as showing that our 16½-knot cruisers are directly at variance with the latest trend of ideas in naval construction, we quote the cruiser "Novik," now under construction in a German yard for the Russian navy. She is said to be the first of a fleet of ten similar ships, whose designer represents the theories of Admiral Makaroff, one of the most brilliant and thoughtful naval strategists of the day. This vessel is to combine the qualities of the torpedo-boat destroyer and the cruiser; and with her armament of six 6-inch rapid-fire guns, and numerous secondary battery, combined with six torpedo tubes of the under-water type, her offensive qualities may be said to be at least equal to those of the 16½-knot cruisers. If sheathed, the "Novik" would displace 3,200 tons. On 300 tons less displacement, she carries 200 tons less coal than our proposed boats, but, as against this, she has a complete protective deck, 1¼ inches on the flats and 2 inches on the slopes. It is when we come to the comparison of speed, however, that the enormous disparity between the two boats is seen, for the "Novik" will be 50 per cent faster, having a speed of 25 knots as against the 16½ knots of our cruisers.

If the facts of the above comparison prove anything, they establish that if we build the six proposed cruisers, we shall possess a class of vessels regarding which we shall be bound to admit that, for their size and date, they are the slowest and most defenseless vessels in the world, and quite unable to stand comparison with similar foreign ships in military, tactical, or strategetical efficiency. Further reference to this subject will be found in our editorial columns.

COMPARISON OF PROPOSED 3,400-TON CRUISERS WITH SIMILAR SHIPS IN OUR OWN AND FOREIGN NAVIES.

Name of ship.....	Proposed Cruisers.	"Montgomery."	"New Orleans."	"25 de Mayo."	"Puglia."	"Suma."	"Novik."
Name of navy.....	United States.	United States.	United States.	Argentina.	Italy.	Japan.	Russia.
Date.....	1899.	1889.	1896.	1890.	1898.	1899.	1899.
Full load displacement, tons.....	3,400	2,229	3,437	3,300	2,650	3,100	3,000
L. W. L. length.....	292 ft.	298 ft.	346 ft.	325 ft.	269 ft.	306 ft. 8 in.	347 ft.
Extreme beam.....	43 ft.	37 ft.	43 ft. 9 in.	43 ft.	41 ft.	40 ft.	40 ft.
Total bunker capacity, tons	700	340	800	600	750	627	500
Trial speed, knots....	16½	19	20	22·4	20	20	25
Protective deck....	none at ends	none	1¼ in. to 3 in.	2 in. to 4½ in.	1 in.	1 in.	1¼ in. to 2 in.
Battery.....	ten 5-in. r. f. eight 6-pdrs. two 1-pdr. four machine guns one field gun	ten 5-in. r. f. six 6-pdrs. two 1-pdr. two Colts one 3 in. field gun	six 6 in. r. f. four 4·7-in. r. f. ten 6-pdrs. four 1-pdr. four machine guns two field guns	two 8·2-in. B.L.R. eight 4·7-in. r. f. twelve 3-pdrs. twelve 1-pdr.	four 5·9-in. r. f. six 4·7-in. r. f. one 12-pdr. eight 6-pdrs. two machine guns	two 5·9-in. r. f six 4·7-in. r. f. twelve 3-pdrs.	numerous secondary battery
Torpedo tubes.....	None.	2	3	6	2	2	6

The General Liquid Air Company.

The General Liquid Air and Refrigerating Company has been reorganized, and its capital stock has been increased from $300,000 to $10,000,000. We have already described in detail the plant which demonstrated the efficiency of the process.

It is extraordinary that miners still refuse to use the safety lamps, even when they have had terrible lessons in their own mines. A strike is now said to be in progress in one Pennsylvania mine because the miners object to using safety lamps, yet less than two years ago an explosion occurred in the same mine in which several men were killed,

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Science Notes.

Lord Kelvin has been given the freedom of the city of London through the Spectacle-Makers' Company.

The remains of not less than twenty extinct animals have been uncovered by the Wyoming scientific expedition, to which we have already referred. Three tons of bones have been found in two days.

The Belgians are an eminently commercial people. In Antwerp ten traveling commercial scholarships of three years' duration, with an annual income of $1,000, are given to students who most deserve such opportunities.

George Averoff, the wealthy Greek, died recently at Alexandria, Egypt. He was a great philanthropist, and it was due to his generosity that it was possible to revive the Olympic games in Athens, in 1896. He rebuilt the Stadium at an expense of more than $600,000.

Interesting experiments were recently conducted on board the French battleship "Jauréguiberry," to determine the limit of distinct vision at sea. From the "Jauréguiberry" a balloon was held captive at an elevation of 1,300 feet while the "Carnot" endeavored to locate the balloon with her searchlights at distances varying from five to twenty-five miles. The experiments proved that the limit of vision under the circumstances was about twenty miles.

It is reported that Herr Montag, of Mannheim, has succeeded in producing coal artificially. At present the newspaper reports are meager, and according to them the new fuel does not develop poisonous gases, creates but little soot, leaves no slate and but a small amount of ash, the latter resembling wood or cigar ash. The fuel is composed of 92 per cent or 94 per cent of ordinary earth and 6 per cent to 8 per cent of chemicals added. It is said that patents for the invention have been applied for in seventeen countries. If this news proves to be authentic, the developments will be looked for with great interest.

A number of gems are being found in the Lake region, and quite a number of diamonds have been discovered. No less than seventeen well identified diamonds, varying in weight from one-half to more than twenty-one carats, have been discovered in the region of the Great Lakes. The localities in which these diamonds have been found are distributed over an area nearly 600 miles in length and 200 miles in width, with its longer axis trending almost exactly northwest and southeast. Nearly all the diamonds were obtained from the deposits of glacial drift. The colors vary from white to white tinged with green and pure yellow. Several of the stones are remarkably fine gems.

The Randolph & Clowes Company, of Waterbury, Conn., has just been made into a stock company under the name of the Randolph-Clowes Company. They manufacture seamless tubes up to 38 inches in diameter, whereas the largest tubes made in Europe are only 12 to 14 inches in diameter. In this country, until quite recently, except those manufactured by the company to which we have referred, seamless tubes have been made only up to 8 inches in diameter. Of course, in order to produce tubes of anything like a diameter of 38 inches, special machinery is necessary and it naturally requires great experience to produce tubes of this nature. This company has made a large number of torpedo tubes for the government. The large tubes are used for pump linings, fire extinguishers, air chambers, soda fountains, etc.

United States Commercial Agent Atwell, of Roubaix, gives some information regarding Dr. Mendel's treatment for tuberculosis which has created considerable interest in Europe. The treatment consists in injecting daily into the bronchial tubes essence of eucalyptus, thyme, and cinnamon, held in solution in olive oil. The oil descending slowly comes into contact with the walls of the tubes in the upper lungs. The vapor which is set free saturates the air in the lungs and acts on the mucous membrane as far as the air penetrates. Dr. Mendel has treated sixteen tuberculosis patients and two suffering from simple bronchitis. In these cases he has noted, after a treatment of one or two weeks, a lessening or complete cessation of the cough and expectoration, as well as a return of sleep, appetite, and strength.

Dr. Robert Stein, of the United States Geological Survey, will leave Washington some time during August on an Arctic expedition, the object of which will be the exploration of the islands lying north of the continent. They will be landed from the Peary supply steamer "Diana" near Cape Sabine, the eastern extremity of Ellesmere Land. Here houses will be built and a reconnoitering trip will be made westward to ascertain whether the inlets afford communication with the western sea or not. If there is no such communication, the trip to the western coast will be made overland. The winter nights will be spent in taking observations, and the westward trip will be begun about the beginning of March. The explorers hope to be able to reach Cape Eden, and so complete the outline of Ellesmere Land, but the direction of the trip will, of course, be determined by the windings of the unknown coast.

Engineering Notes.

Nearly one thousand bids have been received by the Navy Department for the machinery of the Brooklyn dry dock, which was destroyed by fire last spring. The lowest bid was $165,000. For the six cranes the bids range from $35,000 to $60,000.

There has been great difficulty in coaling the transports at Manila, which has resulted in delay in sending home the volunteers. There is now, however, on the way to Manila a hoisting apparatus which will enable the ships to be coaled at the rate of 600 tons a day.

An explosion has occurred on the "Argonaut," which was in dry dock in Brooklyn. It is said that it was caused by the introduction of a lighted lamp into the gasoline tank of the submarine boat. Three men were injured, but fortunately not seriously. The damage to the boat was slight.

The White Pass and Yukon Railroad will be formally turned over to its owners by the builders on August 20. The forty-mile stretch between Skaguay and Lake Bennett was constructed at a cost of $2,000,000, exclusive of equipment and rolling stock. The work of extending the line to Fort Selkirk will be begun at once and will be continued all winter.

Bombay has a railroad which is used in connection with the sanitation of the town. According to The Engineer, it is over three miles long, and is intended for transporting the road sweepings to a piece of land nearly nine hundred acres in extent. It is considered that this track will fulfill all requirements for about twenty-three years. The sanitary authorities have tried two systems of destructors, but both have been discarded.

Forty-five acres of land on the ocean beach southwest of San Francisco are to be condemned by legal proceedings for the erection of heavy batteries for the defense of the harbor. The site commands the southern approach to the harbor and is admirably adapted for fortification purposes. It has a fine fresh lake in the rear which is fed by subterranean springs. Work on the battery will be commenced as soon as the government secures a title to the land.

A few days ago the final trials of the Holland submarine boat were held over the course in Peconic Bay. The trials were for the purpose of ascertaining the effect of wave motion upon the vessel while going at a high rate of speed while on the surface, and to see if a high speed could be obtained at any increased power. The vessel showed remarkable ability in making rapid headway in moving backward when the power was increased. The trial was made over a thousand foot course, and the time was 1 : 23 ; a trifle more than 112 horse power was used. This gave the boat a speed of about ten knots an hour. The new set of dynamos, to be operated by oil, will be installed in the boat to take the place of those now operated by air.

The gas works of the Logansport and Wabash Valley Gas Company, of Wabash, Indiana, were destroyed by a terrific explosion, which shook the city. The explosion took place on August 7. The superintendent and his assistant had just completed charging the tanks with calcium carbide and water when an ominous bubbling was noticed in one of the tanks, and the water was shut off. There was then an explosion in which there was a column of flame eighty feet high. It carried away the iron roof of the works, which was hurled into the air and then settled down to the ground amid a mass of bricks from the walls. The company installed the acetylene plant less than a year ago. It was probably the first ever put in, in this country, to illuminate a city, although an Italian city has been so lighted for some time. Many plate glass windows in the business part of the town were broken by the shock, but fortunately no one was seriously hurt.

There is a great necessity for the introduction of American safety appliances on foreign railroads. In 1895–96, on the railroads in Prussia more than 250 railroad employes lost their lives by accidents and 550 were injured ; 1896–97, the figures were 264 killed and 667 injured. On the English roads, in 1897, an average of one brakeman in every 274 was killed, and one in every 15 injured. A member of Parliament supplemented these figures with the astonishing statement that in twenty-five years, 1872–1897, among 1,500,000 English soldiers, 1,396 were killed in battle, while in the same period 9,000 railroad employes were killed. This certainly shows that there is great need of an improved type of railway coupling and other safety devices, both in Great Britain and on the Continent. In Russia the government is now introducing American air brakes throughout the railway system, and it is probable that automatic couplers will also be insisted upon. When improvements of this nature are contemplated, those who were concerned with selecting the particular appliances to be employed will not ignore, says The American Exporter, that the United States is the country in which automatic couplers were first invented and in which they have been most universally used.

Electrical Notes.

Two hundred and forty-eight people have been killed by trolley cars within the limits of the old city of Brooklyn, since the introduction of the electric cars.

The Prussian State Railroads have given an extended trial to a system of electric lighting taking the power from the axle. This system has now been abandoned.

According to The Electrical Review, plans are being matured for substituting electricity for steam in the ferry-boats plying between Philadelphia and Camden, New Jersey.

In a new system of pressing cloth, German silver wires are embedded in asbestos laid up between two sheets of card, the two terminals of the wires being brought to opposite corners of the cards ; the whole is then used between the folds of the cloth to be pressed. Contact is made by means of clips. The temperature can be perfectly controlled, and there is no danger of burning the goods.

Each week fuller particulars regarding the destruction of the Volta exposition appear in the foreign papers. We have already on two occasions referred to the instruments used by Volta, which were destroyed. It now seems that almost all of the Volta autograph letters, his books, correspondence and an almost perfect library of books on electricity from the days of his discoveries to the present time were destroyed.

According to The American Exporter Messrs. Vickers Sons & Maxim, Limited, of Sheffield, England, has just placed a contract in the United States for two electric battleship cantilever cranes and trestles and the same number of electric cantilever yard cranes for their great shipbuilding works. This will be the largest shipment of cranes ever made to England from the United States and it will form the largest electric plant of this kind ever erected in England. The contract calls for an expenditure of $350,000.

In Europe, all kinds of schemes are adopted to outwit the surgeons who examine conscripts as to their availability for military service, and the Roentgen rays have unmasked such frauds. Some time ago a soldier in a military hospital claimed to have been bitten by a horse. A photograph of the finger was obtained and five needles were discovered in it. The next day another photograph was taken, and it was found that the soldier had removed one of the needles. The surgeon took out the remaining needles. The soldier had injured himself in order to obtain relief from irksome military service.

The San Juan and Rio Piedras Railway Company has been incorporated at Albany, New York, to operate an electric railway and furnish electric light at Porto Rico. The company will operate the first electric railway and electric power plant on the island. It has purchased a steam road eight miles long and electricity will be substituted as a motive power, the overhead trolley system being used. The work of reconstructing the road has already begun. San Juan will also be furnished with arc and incandescent lights. It is believed that it is the intention of the new company to build a park resort on the sea coast between San Juan and Rio Piedras.

The new power house of the Third Avenue road will be 320 feet long and 250 feet wide. It will rest on a table of concrete 7 feet thick which will in turn rest on piles 40 feet long. There will be thirty-two batteries of large boilers, sixteen engines each developing 4,000 horse power and which can be worked up to 6,000 horse power, consequently the complete system when it is installed will furnish 96,000 horse power. It is said that the generators will be placed between the cylinders of the engines, in order to avoid waste of power in transmission and the use of the long shafts. The current will be generated at pressure of 1,100 volts and will be reduced at branch stations to 500 volts.

Of the thirty-nine street railways in and around Paris, ten use steam motors in one form or another for traction purposes. Two employ ordinary locomotives ; two the Lamm and Francy methods ; four employ the Serpollet system, and two the Rowan system. Other lines use the Mekarski system of compresed air. Four employ self-contained cars operated with compressed air. Six use cars worked by electrical accumulators and two with combined accumulators and overhead wires. One is worked electrically by means of a surface contact ; another, says Electricity, is operated by means of overhead wires and partly by conduit, and still another is propelled by means of a cable.

An American manufacturer of machine tools is now making magnetic chucks, which are designed to do away with bolting, strapping or otherwise fastening down work by the usual methods, which require considerable time. The chucks are made for the planer, lathe or surface grinder. The mechanism consists of an electro-magnet made in box form completely inclosing an electric coil. A switch is provided to manipulate the current, which is taken from the regular 110-volt shop-lighting arc circuit, and any of the chucks can be connected in place of a lamp. An automatic switching device has also been devised for alternately opening and closing the circuit as the platen reverses.

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EXPERIMENTAL TEA GROWING IN THE UNITED STATES.

BY J. A. STEWART.

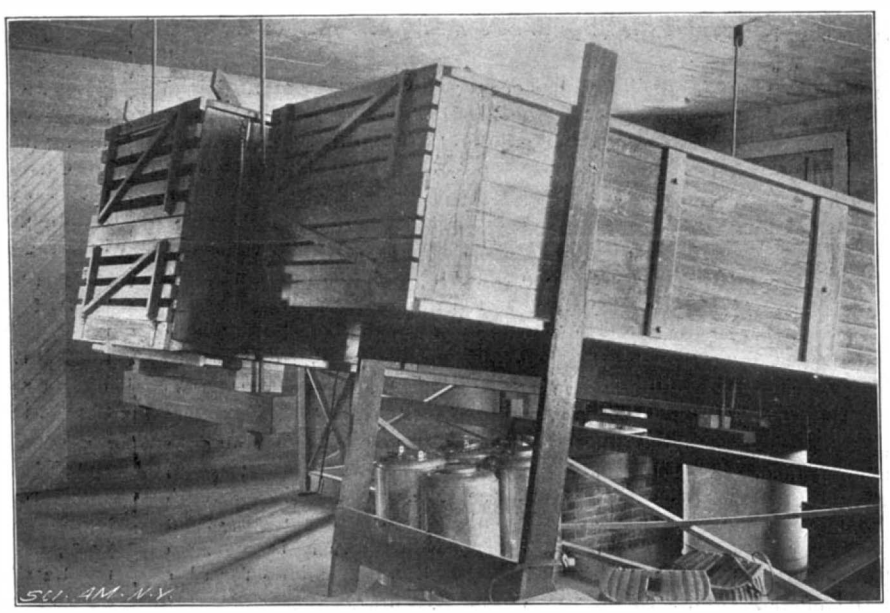
For many years the practicability of tea growing as an industry for the southern districts of the United States has been the object of more or less study and experimentation. Hitherto there has been no feasible solution of the great problem of adaptation, although it has been repeatedly urged that persistent effort accompanied by intelligent study of the subject would bring ultimate success. The expenditure of time and money involved, in addition to the strong doubts of final results, have frequently caused abandonment of the efforts after brief experiment. The great obstacles have been cost of labor and deficiency of rainfall. Oriental wages are so meager that competition is seemingly impossible, and the amount of rainfall deemed essential for profitable production is greatly in excess of any registered precipitation in the South.

The promising results, however, which have recently been attained through the sustained efforts of Dr. C. U. Shepard, of Summerville, S. C., are calculated to attract general attention and to diminish in a large measure the existing incredulity as to profitable production of tea in the United States. Dr. Shepard is a scientist of means and culture whose perseverance and skill have apparently demonstrated that the domestication of the tea industry is a certainty of the near future. His work has recently received the hearty indorsement of Secretary Wilson of the Agricultural Department and of Congress in an appropriation of $5,000 for the use of that department in furthering the scheme of investigation. The public is naturally interested in this subject, which has such an economic bearing, for last year 71,937,715 pounds of tea at a price of 14 cents a pound were imported, representing an industry of $10,000,000.

Dr. Shepard's experiments thus far are chiefly valuable along the line of agricultural science precursory to ultimate victory on an economic basis. His estate, called Pinehurst, consists of about 700 acres of gently undulating grounds dotted with thick woodlands. A large part of the domain is occupied by the Pinehurst Garden Park, devoted to the culture of a noticeably fine collection of ornamental trees and shrubs, including Deodar cedars, Retinosporas, Biotas, Magnolias, Camellias, Cupressus, Junipers, and camphor trees. Hedges are predominant, such as Privets of various species, Spiræa, Hibiscus, Lagerstremias, and Citrus trifoliata, the last an eminently successful barricade against the intrusion of cattle.

About fifty acres of this beautiful estate are set in the tea gardens, which are in a noticeably high state of cultivation. The "Rose Garden" patch of tea, planted in 1890, has been in bearing a sufficient length of time to give measurable results. The chosen site for this initial garden was an old piney woods pond, with its black, rich (in humus) but sour surface soil overlying quicksand and a substratum of clay. The ground was thoroughly subsoiled, drained, and heavily sweetened with burnt marl. It was afterward plowed deeply, followed with a subsoil plow stirring up and pulverizing to a depth of 18 inches or more. In preparation for the garden, the seeds, when received from the Orient, had been at once sown in beds of light fibrous soil and shaded from the direct sun, the native habitat of tea plants being an undergrowth in shady forests. In a few months after the soil treatment about one thousand seedlings of the acclimated Assam-hybrid tea were set out 6 by 6 feet quincunx, and shaded on the southwest side by the insertion of a broad shingle.

There was considerable slowness evidenced in the early growth of the species (which resembles in this respect its relative the Camellia japonica), attributable possibly to the necessity for overcoming the original acidity of the soil. Delay was also occasioned by the erroneous plan of pruning, following the foreign practice and adopted at the beginning, whereby clean stems were maintained, and the loss of many plants resulted. So great was the degree of disappointment at this stage that it well nigh forbade a continuation of the experiment. In consequence, little leaf was picked until 1894, when 151 pounds of green leaves were garnered, later crops being: 1895, 333 pounds; 1896, 600 pounds; 1897, 648 pounds; 1898, 1,200 pounds. Last year the green leaves afforded nearly 300 pounds of Pinehurst best black tea, which retails in Charleston at $1 a pound.



INTERIOR OF PINEHURST (S. C.) TEA FACTORY—DRIERS FOR FIRING TEA.

At present this Rose tea garden contains about one thousand bushes, each bush composed of many stems, the result of cutting out the main stem to induce a luxuriant sucker growth. Two hundred of the younger plants which replaced the older ones that died naturally produce less leaf; and altogether the garden of a little less than an acre contains the equivalent of nine hundred plants in good bearing. The usual number in Oriental gardens is two thousand plants to the acre.

On the basis of nine hundred plants, the production per bush is almost five ounces of tea, which equals the best yield per bush of Ceylon and India and is from two to five times the average of China and Japan. If it were a full acre, the yield of the Rose garden would be nearly 400 pounds of prepared tea last year. And if the plants had been set in closer proximity to each other, as has been done in later gardens of the estate in conformity with Oriental usage, the output per acre would be greater. The Rose garden has not quite attained its maturity. The average yearly production per bush in Japan does not exceed one ounce; in China it is from one to two ounces; in India and Ceylon three to five ounces. In the last named countries there are a few exceptional estates which annually produce over 1,000 pounds of tea to the acre. Dr. Shepard looks for the doubling of the output for a year or two, although he states that it is impossible to estimate the limits of expansion before the plants reach maturity. The increase each year, it is to be noted, has amounted to almost 100 per cent, with the exception of 1897, when a prolonged autumnal drought materially interfered with leaf product.

This gratifying result of an experimental tea garden presages final economic success and attests the wisdom of the methods of cultivation adopted by the grower. Two larger gardens, also formerly piney woods ponds planted with Darjeeling seedlings, promise successful rivalry within a few years; and yet others give token of still greater productiveness.

The main points to be observed in cultivation inhere in the method of pruning; first directed to the gradual extension of the breadth of the plant, thus increasing the number of shoots available for picking, and second, to strengthen these shoots, that their vigor may be maintained up to the last flush and they are able to react quickly in fresh delicate foliage. Both scientifically and economically, this is better than the plan pursued in India (of a single severe pruning every fourth year and a rest the year following), as there is no depreciation in the strength of the plant and no loss of crop entailed.

The experiment has further depended for its degree of success on the selection of plants that will produce fine tea and yet withstand frost, seeds from the higher grades of Ceylon and Assam being too tender, while the older varieties of the plant produced in China will endure a temperature of 25 degrees. The most promising variety, combining hardiness with a good-sized delicate leaf, is that brought from Darjeeling, at an elevation of 3,000 feet.

By means of draining in connection with deep soil cultivation, a more ample and lasting supply of moisture has been secured for dry times. This conservation of moisture is also furthered by a careful system of surface culture which greatly prevents evaporation from the upper stratum of soil. A gain equivalent to a fall of 10 to 15 inches of rain has thus been secured, and tea growing made possible in any region where the yearly rainfall equals 56 inches. Asiatic authorities assert that from 80 to 100 inches are essential and the greater precipitation should come in the early part of the year. Some of the best tea districts are known to have 120 inches of rain per annum. In districts favored with sufficient heat and moisture the operations of manufacture proceed uninterruptedly during the whole period of active growth, the plants furnishing from fifteen to twenty pickings yearly.

TEA GROWING IN SOUTH CAROLINA—PICKING TEA LEAVES RAISED FROM SEED FROM THE "DRAGON'S POOL" GARDEN IN CHINA.

In his method of curing the leaf, Dr. Shepard does not permit direct sunlight to strike the tea leaf either in withering or in the final drying; consequently there is little or no red leaf in the product until the autumnal plucking when it seems to be almost inevitable on account of some unknown chemical changes in the leaf. The Pinehurst black tea is made very largely by mechanical process, which is used in sifting, rolling, oxidation, and firing. Green tea of the highest type has been produced, the sort that gives a pea green liquor and reacts at once on the nervous system. It is made from the same leaves as the black tea, the difference being in the preparation. Green tea has to be made entirely by hand, and is on that account very costly. If fired at a suitable low temperature to preserve its fragrance, it is apt to undergo a change in a couple of months whereby the liquor changes from green to yellow.

The Pinehurst black tea retails in the Charleston market at $1 a pound. It has been pronounced by an expert after an exhaustive test as comparing favorably

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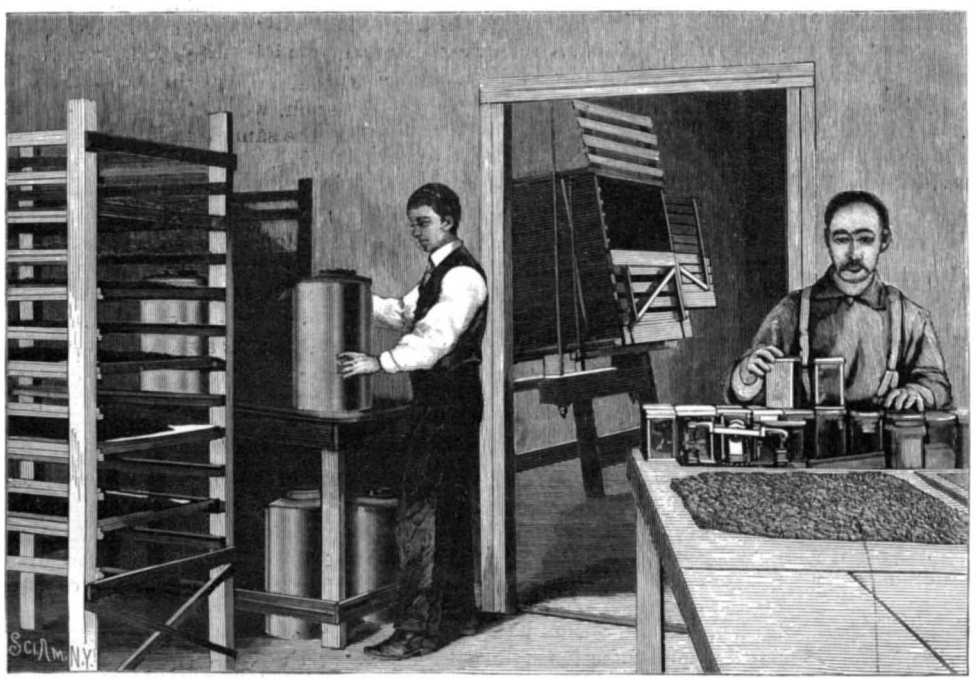
with Ceylon tea selling in the New York market at 25 cents a pound wholesale. It has some of the characteristics of Ceylon tea, but is radically different from Formosa Oolong tea, which it resembles somewhat in appearance.

As is well known, the finest teas made in the Orient will not bear transportation to the United States, and are never seen in this country. As Dr. Shepard is aiming at the production of these finer grades, the leaf plucked from his bushes rarely consists of more than the Pekoe tip and two leaves, and then only to the first Souchong. The picking of a coarser and larger leaf or two would, of course, greatly increase the yield and lessen the cost. The actual cost per pound of the several operations in the growth, picking, and curing of the crop of 1898 were: pruning, 3 cents; manuring, 3 cents; cultivation, 1½ cents; leaf picking, 14 cents; factory work, 6 cents; a total of 27½ cents. Possible reductions on a conservative estimate lessen the cost of production to 16 cents a pound. The chief expense, it is seen, is that of picking, which is about eight times more than the same work would cost in Asia and at present rules out competition as regards the lower price teas.

In facing the difficulty of obtaining laborers when he needed them, Dr. Shepard has hit upon a plan which savors largely of humanitarian endeavor. Seeing the mass of idle young colored people about him, he proposed to give them the elements of an education, providing school house and competent teacher at his own expense, on the conditions that they would learn also to pick tea at reasonable wages for the service, a mutual benefit plan which has resulted favorably to all concerned.

In the establishment of a large tea estate, a considerable initial outlay is naturally required. The expense of raising and setting out the tea seedlings varies from $25 to $50 an acre whether raised from foreign or domestic seeds. A suitably equipped factory is necessary, costing from a few thousands upward, according to the proposed scale of operations. But the permanence of the investment commends it. The best Japanese tea comes from bushes 200 years old. The annual output already realized at the Pinehurst tea gardens reached a total of 3,500 pounds during 1898.

The plan of the National Department of Agriculture to establish a tea farm in every Southern State as soon as this can be done intelligently will lead to more general experimentation by our scientists with these plants of the tropics. Aside from the work of Dr. Shepard very little has been attempted in a strictly scientific manner. The Japanese have done something in the way of analyzing the tea leaves at different seasons, but their conclusions are far from being conclusive or satisfactory.



DYEING, WEIGHING AND PACKING TEA LEAVES.

THE RETURN OF ADMIRAL DEWEY.

Since the time of the nations of antiquity, the homecoming of a great warrior, successful either on land or sea, has ever been the occasion of great demonstrations, such as no other event can inspire, so that we feel no apology is necessary for the presentation of a number of views of Admiral Dewey's arrival and subsequent sojourn at Trieste, Austria. The American people hold Admiral Dewey particularly dear by reason of his daring achievements at Manila. To-day personal valor in the navy is not to be underestimated, but it is the mind rather than the hand which wins the day. It takes a brave officer to run his vessel through a harbor protected by contact and observation mines, and this warfare, in which brain power plays such an important part, has begotten an entirely new type of sailor. Admiral Dewey is such a man. With experience in a previous war when ironclads were in their infancy, he combines all the skill of the old school with that of the modern officer who learns from day to day, and who is constantly on the alert to gain information regarding vessels "built and building" or on guns and armor.

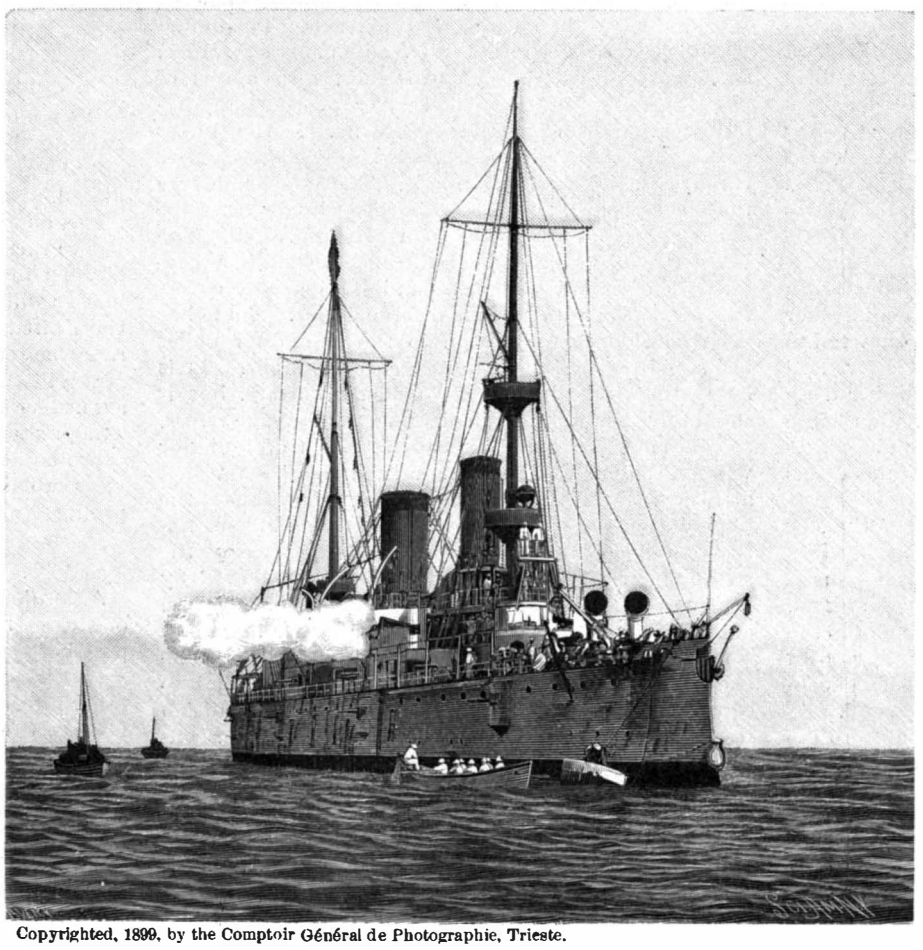
The battle at Manila Bay occurred at a most opportune moment, allaying our fears that we were unprepared, and striking terror to the Spanish arms. It was the beginning of hostilities and the beginning of a victorious end. The battle won, Admiral Dewey remained at his post administering the affairs of the unsettled community until even he felt the need of a rest, and he is now making his way westward on the flagship "Olympia" via Hong Kong, Colombo, and the Suez Canal, and then by way of Europe, and he will probably arrive at New York about October 1, where he will receive such a welcome as no other American has ever had.

The "Olympia" reached Suez July 13, and then it was known that Trieste would be the first European port to bid him welcome. The "Olympia" reached Trieste on the morning of July 20; she came into port with her colors flying and exchanged the twenty-one gun salute with the fort. Our engraving is made from a photograph taken as the first gun of the salute was fired. Consul W. S. Hossfeld boarded the cruiser and exchanged congratulations with the Admiral. Subsequently the Port Captain, the Captain of the "Amphitrite," and the Admiralty Captain, in the absence of the Austrian Admiral, boarded the "Olympia" and welcomed Admiral Dewey. The Hon. Addison C. Harris, American Minister to Austro-Hungary, with his first secretary, and Captain Beehler, Naval Attaché to the American Legations at Berlin, Vienna and Rome, next arrived, and then came the local authorities. One of our engravings shows Minister Harris leaving the "Olympia." Among the other visitors were consuls of several countries and various officials. Then followed a round of visits which the dignity of the Admiral's high rank demanded, and all were greatly charmed with his affability and modesty. A banquet was given in the Hôtel de Ville by Minister Harris. The military authorities posted a guard of honor outside the hotel where the Admiral was stopping.

The visit of the "Olympia" to the port created great interest, and all day long the piers were crowded with persons anxious to see the vessel or to catch a glimpse of the unassuming victor of Manila Bay, and small boats constantly crowded around the cruiser. On July 22, Admiral Dewey visited the park and castle of Miramar, which was built by Maximilian, whose brief occupancy of the throne of Mexico ended so soon in death. The Admiral was particularly interested in the many mementoes and reminiscences of the Prince which were scattered about everywhere according to the good old conservative European custom. In the evening, a banquet of twenty-two covers was given on board the "Olympia," and the next day a visit was made to Optchima, an elevation of 1,035 feet, which commands a beautiful view of the city and harbor. Notwithstanding the fact that Admiral Dewey objects to have his photograph taken, he found photographers everywhere, and he is said to have been greatly amused by the assiduity with which he was pursued. One of our engravings shows the Admiral with Captain Lamberton and Consul Hossfeld and Lieut. Brumby paying official visits, and the Admiral walking and driving in the park at Miramar. At the various dinners which took place and in the official calls, Admiral Dewey never once let fall a single word which even the most ingenious diplomat could twist into an opinion on international problems.

While at Trieste, he cabled that the arrangements made for his reception at Washington were satisfactory to him, and he will soon have the greatest honor ever conferred on a soldier or sailor in the history of our country, the sword voted to him by Congress being presented to him by the President on the steps of the Capitol at Washington.

On August 1, the "Olympia" sailed for Naples at four o'clock in the afternoon and arrived at that beautiful city on the morning of August 5. An enormous crowd assembled to see Admiral Dewey, and all who are familiar with the mercurial temperament of the pleasure loving Neapolitans will not be surprised to learn that their greeting was enthusiastic, and they cheered him lustily. Many buildings displayed American colors and the reception by the Prefect and municipality was most cordial. Italian officers are to give the Admiral a dinner on a warship, and he has been asked to be present at the launching of an armorclad and there seems to be no chance of a dearth of amusements. His further movements have not been made public at the time of going to press. It is considered very doubtful if he will visit England, but it is greatly desired in that country that such a visit be made.



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ARRIVAL OF THE "OLYMPIA" AT TRIESTE—THE SALUTE.

Decision in the Griffin Mill Case.

The Bradley Pulverizer Company have won their case in their appeal from the decision of Judge Kirkpatrick, of the Circuit Court of the United States for the District of New Jersey, who decreed that the Griffin mill did conflict with the patents of the Huntington Dry Pulverizer Company.

In order to absolutely settle this question, the Bradley Pulverizer Company appealed from this decision to the court of final record in patent matters, the United States Circuit Court of Appeals for the Third Circuit, Judges Acheson, Dallas and Buffington presiding, and that body has rendered an elaborate opinion, reversing the decision of Judge Kirkpatrick, and sustaining the Griffin mill patent, saying: "In short, we have reached the conclusion that, both in construction and mode of operation, the two machines are essentially dissimilar, and that, therefore, they cannot be regarded as being, in the sense of the patent law, substantially identical.

"It follows that the decree of the Circuit Court must be and it is reversed; and the cause will be remanded to that court with direction to enter a decree dismissing the bill of complaint with costs."

It will thus be seen that the Bradley Pulverizer Company have won their case, and established the fact that the Griffin mill is radically different, both in structure and in principle, from those of their competitors.

THERE are 45 admirals in the French navy and 330 generals in the French army.

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Philippine Fruit Bats.

BY PROF. J. B. STEERE.

A few species of the larger bats of South America vary their ordinary foods now and then by sucking bananas and other soft fruits; but in the East Indies a whole family of bats has become exclusively fruit-eating. In correspondence with their change of foods, these bats are of large size, some of them being nearly as large as cats, with wings that measure five feet in extent. From their large size, sharp noses, upright ears, and ofter ruddy color, they are sometimes called flying foxes.

The warm climate of the Philippines, with the continual ripening of fruits throughout the year, make them peculiarly favorable to the multiplication of fruit bats, and five or six species at least are found there. They do not roost, like other bats, in caves and hollows, but suspend themselves from the branches of trees. They make no attempt at concealment, which from their large size would be difficult, but congregate in great numbers, hundreds together, in some place far removed from the thick forest. They sometimes choose a lone tree left on the plain. In other cases they retreat to some small island a mile or two from the mainland. They also frequently choose the clumps of prickly bamboos about or in the native villages. These roosts appear to be permanent, being occupied from year to year. Their fear of the forests, and their peculiar choice of roosting places, must have been determined by the character of their enemies, but just what those enemies are seems as yet undetermined. Perhaps their habits were formed before their ancestors left the mainland of India.

They are, of course, most helpless during the daytime, when they hang exposed to the view of everything that passes. Carnivorous mammals are rare in the Philippines, being almost limited to a few species of civet cats. These would not refuse a meal of fruit bats, and they are also able to climb well, but like the bats they are nocturnal in habit, and would find the bats alert or away from home.

Perhaps the monkeys, which are everywhere abundant, may feed on the bats when they can be captured. The larger hawks and eagles are found in great numbers and of many species in the Philippines, and among these is the great monkey-eating eagle, which no doubt frequently contents himself with bats, when his more wily prey escapes him.

During the day the bats, when undisturbed, hang as quietly and apparently as lifeless as great hanging birds' nests; but as twilight comes on they leave their roosts by ones and twos and threes and fly to the forests and fruit trees and cocoanut groves.

The roosts are usually many miles apart, but the bats spread themselves over the whole country, and probably fly to distances of eight or ten miles without difficulty. They create great havoc in the fruit orchards, and compel the fruit grower to gather his fruit long before it is ripe. They also interfere seriously with the making of tuba (palm beer), the common native drink. While the poor tuba gatherer is fast asleep, they visit the cocoanut groves, where the sweet juice from the great blossom spathes is being collected for tuba, and drink from the bamboo cups. Snares and scarecrows are hung in the trees, but with little effect.

Sometimes the juice has already fermented enough to make them drunk, and then instead of making their way back to their roosts before daylight, they fall to the ground and are at the mercy of the crows and swine. Several of these drunken bats were picked up by the Indians and brought to us for sale, and a large proportion of the bats procured by us for our collections were found to have their stomachs full of this sour palm juice.

The little island of Santa Cruz, in front of the city of Zamboanga, and forming part of the harbor, has one of these bat roosts upon it, the bats occupying a low mangrove swamp which is flooded at every tide. Every evening the bats could be seen flying across the harbor and over the city, some of them dropping down into the fruit trees along the streets and others keeping on to the wooded hills and mountains beyond.

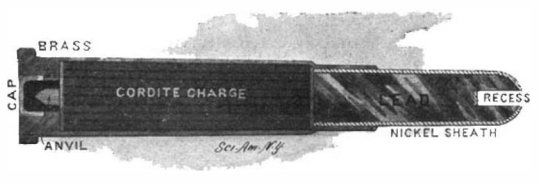
By the light of the street lamps I was able to see how these animals, whose hands had turned into wings, were able to eat fruits. They were feeding in the low talisay trees which had been planted along the streets for shade. The fruit of these was green and of the size of a small peach, and having a thin layer of flesh over a large pit. The bats were crawling about through the trees, carrying the wings partly folded, and hooking their way along by means of their short thumbs, which stand out from the inner edge of the wings and are provided with large curved claws. When they had found a fruit to suit them, they would swing down by the hind feet from a branch above and grasp the fruit between the thumbs. It is a wasteful way of eating, and the next morning I found many fruits under the trees with the marks of their claws and teeth upon them. I visited this bat roost in 1874, and again in 1887, twelve years later, when it appeared to have changed but little.

While in the northern part of the island of Panay, we visited one of these roosts at the little village of Sara. The bats here occupied a number of clumps of tall prickly bamboos which overhung the native houses. They had become accustomed to the people passing beneath them, and at first paid no attention to us. They were hanging, head down, by the hind feet, and with the wings closely folded and twisted about the body, and might have been taken for some strange, great fruit as they hung there in the burning noonday sun. When we fired among them, they rose by hundreds, squealing, into the air, and after wheeling about over our heads like great specters for a few minutes, they would again approach the trees, and throwing the body nearly upright, they would thrust the hind feet forward, and grasping a branch, would fall head downward, folding their wings at the same time.

As soon as they became alarmed, they would take flight at our approach, and we found that they could see quite well, even in bright sunlight. There were at least three species, differing in size and color, roosting there together, though each species seemed to occupy distinct trees. The fruit bats have a strong bat odor, but the natives of the village came in while we were skinning our specimens and carried the bodies away for eating.

THE ENGLISH MARK IV. CORDITE AMMUNITION.

The Peace Congress considered the "Dum-dum" bullet at considerable length, and England strongly opposed any restrictions against its use among savage tribes. There are certain cases, however, where its use really seems to be advisable. When dealing with fanatics like the Soudanese, a war of extermination must be carried on, and the Dum-dum bullet seems to be the most effective remedy for placing the enemy hors-de-combat, and the bullets are also used in the prison of one of our Western States. Nowadays all the chief powers have small-bore rifles and are liable to become involved in warfare with more or less savage races, as when their colonial possessions are menaced, so that many of them doubtless desire to use the most effective bullet possible. Our engraving shows what is known as the English "Mark IV." cartridge containing a cordite charge as sent to the Cape. The bullet has a hollow in the head, and the nickel sheath ends



THE ENGLISH DUM-DUM BULLET.

on a lip at the entrance. A small disk of nickel is forced down to the bottom of the recess. This bullet when it comes in contact with any moist substance, such as the living body, spreads out into a sort of rounded knob, but the nickel cover prevents any flying or separation of the fragments. If the bullet strikes any hard substance, such as wood, it passes through it, cutting a clean hole. The cordite charge takes the place of the powder in the ordinary cartridge and it is set off by means of a cap and anvil. The Peace Congress prohibited the use of bullets covered with a hard outer case unless the case covers the core entirely and is free from incisions. There has been considerable objection to the Dum-dum bullet because it is said it does not carry straight. It is likely that it is doomed for modern warfare, but it should not be forgotten; in dealing with savage tribes, they are not particular as to what form of bullet or weapon they use. This ammunition has been tested at Bisley, England. Some of the cartridges caused the bore of the gun to become obstructed and momentarily checked the free expansion of the gas by the stripping on the nickel sheath; this was followed by injury to the guns such as the blowing out of breeches, etc. Cordite is a true explosive, and its use in guns of small caliber requires that the cartridges shall be mechanically perfect to avoid obstructions which tend to cause the barrel to be shattered. The ammunition tests at Bisley showed that economy must not be considered where cordite is used.

A Woman's Invention.

A woman inventor of Bradford, England, has designed a most ingenious apparatus for the removal of wool from skins by electricity. This is an interesting example of what a woman inventor can do when she sets her mind at work on some practical problem. The machine consists of an electric cautery or fleshing knife in such a handy form that the wool may be shorn or cut rapidly from the skin without injuring either the wool or the pelt. Electric cables pass through the handle and are connected to the two terminals. From this the current is passed through a wire of platinum-iridium which is thus rendered incandescent. The wire is fastened to and supported by a highly refractory substance specially made for the purpose, the current requiring about 60 amperes at a pressure of 4 volts. The method of removing the wool, says the English Electrical Engineer, is to push the cautery along the surface of the skin. The red hot knife mows down the wool, and the only limit to the speed with which the work can be done is the deftness of the operator. The work is performed so quickly that the heat in no way injures the skin or the wool. It is without doubt a very ingenious and valuable invention.

The Nobel Prizes.

At last the question of the Nobel prizes has been finally decided and definite arrangements have been made. After settling up the estate, it was found that the amount available for prizes exceeds $7,500,000. According to the will of the Swedish inventor, his vast wealth was to be invested and the proceeds distributed to five persons who make the most important discovery or invention of the year. The prizes to be distributed are given annually for discoveries and inventions in physics, chemistry, medicine, and also for the most meritorious work in literature. The fifth prize is to be awarded to the person who has done the best work for advancing the fraternization of nations and for diminishing armies and the propagation of peace. Five institutions, to be called the "Nobel Institutes," are to be created. Each is to be managed by the body to whom the decision was left regarding the prizes, as was originally arranged for by the late Alfred Nobel. Thus the Nobel Institute for Chemistry and the Nobel Institution for Physics will be under the management of the Academy of Sciences of Sweden, that of Philosophy and Medicine will be managed by the Carolin Institute of Stockholm. The literary institution will depend upon the Swedish Academy, etc. Each of these institutions is to be provided with libraries, laboratories, etc., for the accomplishment of the object in view. Each will dispose of 300,000 crowns, or about $60,000, from which the expenses of administration are to be provided. Each of the five prizes will amount to about $40,000. The first distribution will take place in December, 1901, and the annual date for such distribution is to be the 10th of December, the anniversary of the death of Alfred Nobel. The prizes will be given on the recommendation of those entitled to present candidates, such as the institutions in Stockholm, certain foreign scientific societies, academies, universities and high schools. They can alone make proposals for the scientific and literary prizes, while the Norwegian Diet or parliaments of other nations only can put forth candates for the prize for the propagation of peace. The proposals must be made in one of the Scandinavian languages or in German, English, French or Latin. No other language will be considered, and personal application will be entirely useless. Each fortunate recipient of a prize will receive a diploma and a gold medal bearing the portrait of Alfred Nobel. Of course, the prizes will be distributed without any reference to the nationality of the contestants.

The Prize for Life Saving Devices.

We are now able to give some additional details regarding the Pollok prizes, although final details can only be given as soon as definite rules have been formulated. Notification to foreign governments has been made, and steps will be shortly taken to lay the matter before them so that they can announce it to their own citizens in the most approved way. Details of the matter will be placed in the hands of Lieut. W. S. Sims, the United States Naval Attaché at Paris. The arrangements for the competition will then be made. Mr. William Ker, of Washington, has been selected to act as secretary of the committee for the United States. The prizes will be awarded at the Paris Exposition. It is probable that there will be a large number of devices submitted, and the competition will certainly be productive of good.

Fruit of Grasses.

According to the view of M. P. Guérin, the ovule of grasses has, in general, two integuments, each composed of two layers of cells. The outer integument always disappears shortly after fertilization, while the inner integument is persistent, and constitutes a true testa to the ripe seed. In some cases, as in Bromus and Brachypodium, the epiderm of the mucellus takes part in the formation of the integument. In the pericarp the absorption is more or less complete; the endocarp usually persists in the form of long isolated cells or of a sclerified ring. Except in a few cases, there is a complete fusion between the pericarp and the integument of the seed justifying the retention for the fruit of grasses of the special term caryopsis.—Morot's Jour. de Bot., 12, 365.

SOME interesting particulars as to the extent and cost of fox hunting in England were given the other day by Lord Bathurst. There are now 221 packs of fox hounds in the United Kingdom—180 in England, 26 in Scotland, and 15 in Ireland; and these packs consist of 8,000 couples of hounds, and they necessitate the employment of 100,000 horses of the value of $35,000,000, involving an outlay of $25,000,000 per annum for their maintenance.

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EDWARD ORTON.

BY MARCUS BENJAMIN, PH.D.

When the council of the American Association for the Advancement of Science, met in Boston last summer to decide upon a place in which to hold the meeting this year, invitations were presented from several cities, but the cordial and earnest words of the representatives of Columbus, Ohio, proved irresistible, and it was decided to accept the invitation from that place. So strong a plea was presented by them that when the choice of a president came to be considered a few moments later, the unwritten but time-honored rule that a representative of the physical sciences be chosen to succeed a representative of the natural sciences was passed over in the desire to do honor to the distinguished State Geologist of Ohio.

Edward Orton was born in Deposit, N. Y., on March 9, 1829, and he is the son of the Rev. Samuel G. Orton, a Presbyterian clergyman of well known standing in New York State. The boy spent his early life in Ripley, Chautauqua County, and there obtained a common school education. He was ambitious, and desiring greater knowledge, opportunities were afforded him to procure a college course, and he entered Hamilton, where he was graduated in 1848. The home influence is clearly indicated by his desire to follow in the footsteps of his father, and he began his theological studies in the Lane Seminary, where Dr. Lyman Beecher was then dominant, and later he studied at the Andover Theological Seminary.

No student of the history of science in this country can ignore the wonderful advancement of science that followed the coming of Louis Agassiz to America; and beyond doubt it was his influence, direct or indirect, that led the young student of theology to turn his steps toward Harvard and enter the Lawrence Scientific School, where he came in personal contact with that great master.

The wise words of the poet, "Knowledge comes, but wisdom lingers," were fully appreciated at the Lawrence School in those days, for the students were taught to think. Thinking students make good teachers, and good teachers are successful men. In President Orton's career this fact is clearly demonstrated.

Soon after completing his studies, he accepted a call to the chair of natural sciences in the State Normal School in Albany, N. Y., and there began a successful career of teaching, which he has never abandoned. In 1865 he was invited to the professorship of natural sciences in Antioch College, Yellow Springs, Ohio, and of this institution he was made president a few years later.

Success was the result of his ability to teach, and his reputation extended beyond the limits of his own college, for he was called in 1872 to the presidency of the Ohio State Agricultural and Mechanical College in Columbus, Ohio, with charge of the department of geology. Later, that college became the Ohio State University, and the duties of its president became more onerous, and in 1881 he resigned from the higher office, but retained his professorship of geology.

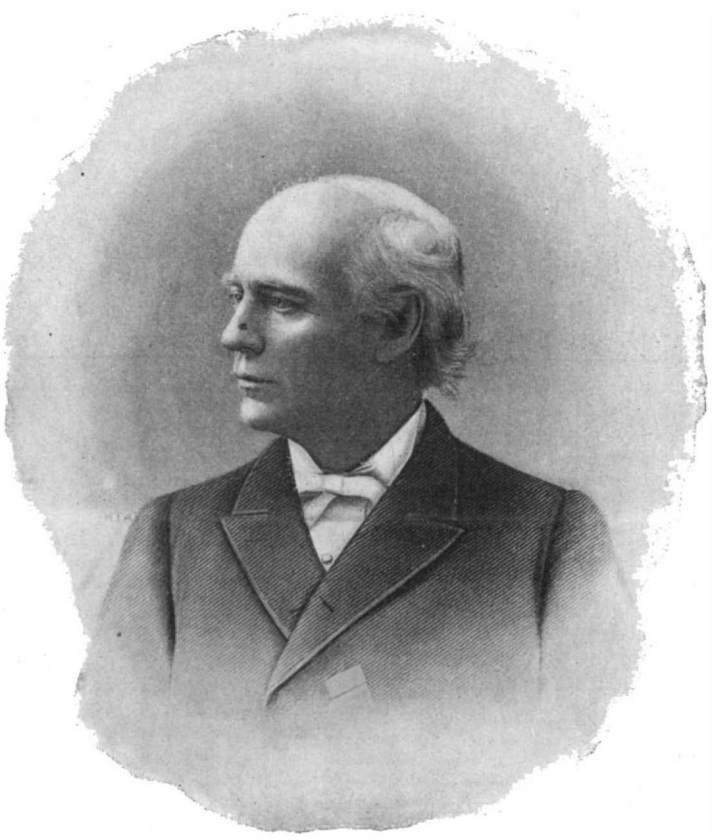
As a geologist President Orton has gained for himself also a high place among his contemporaries. During the years 1869 to 1875 he was assistant State geologist under the able and gifted Newberry, and then after a brief interval returned to the survey in 1881 as State geologist with full charge of its work.

His special investigations have shown a leaning toward the development of the economic wealth of Ohio, and his published writings include the two volumes of the "Economic Geology of Ohio," issued in 1883 and 1888, and his valuable report on "Petroleum and Inflammable Gas," issued in 1887.

One of the finest of the University buildings was named Orton Hall in appreciation of his services both to the State and the University. The building, which cost more than $100,000, is of decided architectural beauty and contains a series of geological specimens collected from every part of the State. It is regarded "as a monument to the worth and work of Doctor Orton." Other honors have come to him. The degree of Ph.D. was conferred upon him by his alma mater in 1876, and on his retirement from the presidency of the Ohio State University in 1881 that institution gave him the degree of LL.D. Scientific societies have recognized his worth, and he was president of the State Sanitary Association of Ohio in 1884–85, and later of the Geological Society of America.

He joined the American Association at its Troy meeting in 1870, and five years later was advanced to the grade of fellow. In 1885 he presided over the section on Geology and Geography at Ann Arbor, but "a fitting crown to his long and useful life was placed on his brow last summer when the American Association for the Advancement of Science made him its president."

It has recently been well said of him, "as a scientist of rare attainments, and as a man of rare personal charm, Dr. Orton has always retained the admiration and the affection of the University, the community, and the State." We hail him as a worthy successor of Agassiz and Newberry in the presidential chair of the American Association.



Edward Orton

PRESIDENT OF THE A. A. A. S.

Women Inventors.

Rev. Ada C. Bowles gave an interesting talk lately on "Women as Inventors," the result of twelve years' research, the substance of which is reprinted in The Woman's Journal. She said that in China silk-weaving was invented by the wife of the fourth emperor, for which divine honors are still paid to her. Japanese bronze work was the invention of a woman. In India the weaving of Cashmere shawls was invented in the seclusion of the harem by a woman, who also gave so wise consul to the prince, her husband, that he changed her name from Nourmahal (Light of the Harem) to Nourjehan (Light of the World), and had coins struck bearing this title. Attar of roses was invented either by the same woman or by her mother, the authorities differing on this point.

The secret of Venetian point lace which had been lost in the thirteenth century, was rediscovered in this by an Italian work-woman. The beautiful gauze called "woven wind" is a woman's invention. When Harriet Hosmer took her Yankee brains to Rome, she found out the way to make marble from limestone, which the Italian government had long been seeking.

In this country women's progress in invention has kept pace with their progress in education. Mary Kees was the first American woman to take out a patent, in 1808. It was for weaving straw with silk or thread. At this time girls received hardly any education. During the next quarter of a century only fifteen patents were taken out by women. These included a globe for teaching geography, a baby-jumper, a fountain pen, a deep-sea telescope, and the first cook-stove.

By 1834 women had a few more educational privileges, but not many, and in the next twenty-five years women took out patents for thirty-five inventions. By 1859 high schools were opened to women, and the war was coming. The high schools taught them to use their minds, and the war forced them out into many new avenues of work. During the quarter of a century from 1859 to 1884 the number of inventions patented by women rose to 1,503. Women who took their husbands' places on the farms invented many improved agricultural implements especially at the West; women went into the shoe-shops, and at once began to take out patents on machinery; women nursed in the hospitals, and invented improved bandages, canteens, camp-beds, etc. Colleges, Sloyd, and manual training are now developing the latent inventiveness of women, and during the twelve years from 1884 to 1895, the latest date to which the Patent Office reports have been published, women have taken out 3,905 patents.

Some large and important inventions are due to women. Mrs. Harriet Strong, who began by inventing a corset, afterward moved with her husband to California; and since his death she has taken out patents for reservoirs and dams. She is now an old woman, but the other day I saw that she had just patented a device for the storage of water. Mrs. Ada Van Pelt, while her husband was postmaster at Oakland, Cal., invented a permutation lock with three thousand combinations; also a letter-box for the outside of houses, that throws up a signal when there is a letter inside for the postman to collect. This is now in daily use. Satchel-bottomed paper bags were invented by a woman, who was offered $20,000 for the patent before she left Washington. An invention which revolutionized the making of screws originated with a little girl. A woman invented the Burden process of making horse-shoes, which turns out a perfect horse-shoe in an incredibly short time. This invention has saved the country $2,500,000 in fourteen years. Yet there are still many persons who believe that women cannot invent.

The Consumption of Quinine.

More than 125,000,0 0 grains of quinine have been consumed by American soldiers during the past year. In some cases men who were in the hospitals in Cuba and Porto Rico used as much as 300 grains a week, and hardly any have failed to use the drug at some period of their service. It is stated that the people of this country consume one-third of the quinine of the world, the drug being used in the preparation of many patent medicines, tonics, bitters, cold cures, etc., as well as in pills and in bulk, and a considerable quantity is consumed in the manufacture of hair tonics. The official figures in the Treasury Bureau of Statistics show that there were imported last year, into the United States, 1,539,056,750 grains of quinine, and as there was practically no export of this article, this means that the consumption of quinine was about twenty grains for each inhabitant. As is well known, quinine, Peruvian bark, and calisaya bark are the products of the cinchona tree, which is a native of western South America, more particularly of Peru and Ecuador. Now, however, but a small part of the supply comes from that region. At present two-thirds of the quinine consumed is produced in Java from cultivated trees. For many years the Dutch government was urged to undertake the cultivation of this plant from Peru. Finally this was accomplished and a large number of specimens of the different varieties were obtained by botanists, who took them to Java in 1852. The English government also started cinchona plantations in India which now produce large quantities of quinine.

The Cambridge Anthropological Expedition.

Certain members of Dr. A. C. Haddon's expedition to New Guinea and Borneo, including Dr. Haddon, have returned and the members are now actively engaged in arranging their facts and specimens. The main object of the expedition was to continue and supplement the investigations on the Torres Straits islanders that Dr. Haddon commenced ten years before. The islands lie between the smallest continent and the largest island in the world, and it is important to definitely establish the affinities of the natives and to record their customs and beliefs before they entirely disappear or become inextricably modified by contact and mixture with alien races. The Murray Islands were selected for the most prolonged and careful study. These were the most isolated and less accessible islands. The natives are less in contact with the pearl divers who have so modified the natives of the other islands. They have for a long time, however, been well under the control of the missionaries, so that most of their former practices have been abolished. Numerous natives were photographed and measured, and some of the old men were able to give information respecting their former customs and ceremonies. A psychological laboratory was instituted, and this is the first occasion on which trained psychologists have experimented in the field on a primitive people. The numerous ethnographical and anatomical objects collected during visits to the main island of New Guinea together with those obtained in the islands of Torres Straits form interesting and important additions to the collection in the Cambridge University Museum at Cambridge, England.

The Longest Asphalted Street in the World.

Philadelphia can boast of the longest asphalted street in the world. Broad Street has that unique distinction. First, as already stated, it is the longest asphalted street in the world; secondly, it is the only street which is of even width for eleven miles, and this width is the greatest ever attained by any street for a course of eleven miles. It is also the straightest street, for from League Island to the county line it does not vary an inch, except where the great city building causes the street to turn around it. Seven miles of the street are asphalted, but the remainder is provided with a roadbed of fine macadam, which is continued by the old York road, which extends for about twenty miles farther on. A carriage can drive on this street and road and make only one turn in thirty-one miles. Broad Street is 113 feet wide and measures 69 feet from curb to curb, and thirty-five men can walk abreast of it.

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The New Kachin and Acetone Developer.

In the Photogram Mr. W. Ethelbert Henry gives the following formula for a single combined developing and fixing solution:

A.—Sodium sulphite crystals..	30 grammes,	or	3 ounces 6 drachms.
Distilled water.....	75 c. c.	"	9 " 3 "
Caustic soda, pure.....	7 grammes,	"	7 drachms.
Kachin.....	7 "	"	7 "
B.—Hypo.....	20 "	"	2 ounces.
Water.....	100 c. c.	"	10 "

For use, take twelve parts of A, 20 parts of B, and 30 parts of water. The mixed solutions form a combined developer and fixing bath which works with great rapidity, fixation and development taking place at the same time. It is well to bear in mind, however, that plates must be fully exposed for this treatment, which is quite unsuitable for under-exposures. A few trials will also be necessary in order to determine the most suitable quantity of hypo solution for the particular brand of plates in use, some requiring more than others to give the best results. The negatives produced by this means are quite brilliant and free from any indication of fog. The next formula is one that I have found gives better results in a shorter time than any other yet worked out. It is open to improvement, no doubt, but it works so rapidly and excellently that I give it as it stands, leaving any improvement that may be made for publication in the future.

Three solutions are requisite as follows*:

A.—Water.....	250 grammes,	or	10 ounces.
Sodium sulphite	25 "	"	1 ounce.
Kachin.....	5 "	"	96 grains.
B.—Lithium oxide.....	3 "	"	58 "
Water.....	250 "	"	10 ounces.
C.—Acetone.			

If very rapid development with extreme contrast is desired, take A, 1 part; B, 1 part; water, 1 part. This developer is very energetic, and is not suitable for over-exposure; development starts in about three seconds, and is generally complete in less than a minute. For the development of snapshots with detail and density the following is highly recommended: A, 3 parts; B, 3 parts; C, 2 parts. This combination works very rapidly, giving complete development in from 60 to 90 seconds. The addition of 2 parts of water to the foregoing slows development to a slight extent, but gives a brilliant negative in less than two minutes in most cases.

I find "Kachin" particularly suitable for "stand" development, the following being the proportions: A, 3 parts; B, 3 parts; C, 2 parts; water, 50 parts. This is the strength that so far has given the best results, development of under-exposures being completed in about 40 minutes. There is no doubt that the time of development may be materially governed by increasing or decreasing the added water; for instance, with 100 parts of water instead of 50, two hours were necessary to effect the development of a snapshot. With this long development there was no stain or fog, and the plate fixed rapidly. On the other hand, I have left a plate to develop itself in a solution containing only 20 parts of water, yet the negative (developed in 15 minutes) was quite free from sootiness.

* The following being for development only, it is, of course, necessary to fix the negatives in a 20 per cent solution of hypo.

The Production of Gold for 1899.

The world's production of gold for 1899, if Australia and South Africa maintain the rate with which they began the year, will probably reach $340,000,000, or about $50,000,000 more than in 1898. At the end of the current year the three principal countries will rank in the following order in the list of gold-producing districts:

South Africa.....	$106,000,000
Australia.....	78,000,000
United States.....	74,000,000

The State of Washington, it is thought, will far exceed its usual production; and the Klondike, which in 1897 and 1898 produced respectively 6,027,000 and 13,700,000 dollars' worth of gold, it is estimated will yield in 1899 at least $20,000,000 in yellow metal.

Arctic Food.

A company was recently formed for the breeding and raising of reindeer in eastern Norway, for the purpose of supplying southern markets with reindeer meat. There is a growing market for this meat in France and Belgium. Reindeer are quite cheap in this part of Norway, and 2,400 animals were purchased for $7,500. In a short time it is believed that 1,000 deer can be killed a year without diminishing the herd. A slaughtered deer is worth about $7.50. In order to prevent the market from being flooded with fresh deer meat, a canning plant will be attached to the farm. The company controls about 60 miles of mountain land. The reindeer is the real Arctic venison and is a highly approved article of food in the northwestern part of Europe. A considerable part of the supply comes from lands far north of the Arctic circle. Russian bears have also been on the market in London and Paris, where they are much esteemed. The business of importing frozen game from the far North is a comparatively new one, but it is rapidly developing into an important industry.

The Current Supplement.

The current SUPPLEMENT, No. 1233, has many articles of more than usual interest. "The Automobile Race 'Tour de France'" describes this most important race. "Elevators," by Charles R. Pratt, illustrates several of the leading types of elevators. "Life on the Schoolships of the German Navy" describes the instructions in seamanship which are given. "The Electrical Protection of Safes and Vaults" is an article by Clyde J. Coleman. Probably the most interesting article in the entire paper is "Variations in Human Gait," by Dr. E. H. Bradford. It is most profusely illustrated and is a highly important paper on the subject.

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RECENTLY PATENTED INVENTIONS.

Bicycle-Appliances.

DRIVING GEAR FOR BICYCLES.—ARTHUR DOYLE, Seattle, Washington. The gear consists of a pair of toggles suitably pivoted upon the bicycle frame and connected to a gear wheel or sprocket which is in gear with the driving sprocket of the machine. A pedal is mounted upon the primary toggle and the necessary power is transmitted through it by means of a short vertical motion. A hand lever is also arranged to be used when auxiliary power is needed. By means of this driving gear, a short up-and-down movement of the rider's feet is said to develop a large amount of power and to run the machine at a high rate of speed.

BICYCLE DRIVING GEAR.—CHARLES H. SPERLE, Third and Sixth Avenue, Williamsbridge, New York, N. Y. This device consists of a lever pivoted at one end to the bicycle frame near the rear wheel, and carrying a pedal on the forward end. The lever is connected by a pitman to a gear wheel, also fastened on the frame and meshing with the driving pinion on the rear wheel.

Engines and Valves.

ENGINE.—GABRIEL P. B. HOYT, Jamaica, Borough of Queens, New York, N. Y. The object of this invention is to provide an engine capable of running at a high rate of speed without much vibration. It seems especially applicable to explosive engines as a means of reducing vibration. A transverse elongated slot extends across the center of the piston, and in this slot travel the wrist pins of two crank arms, which rotate two transverse shafts in opposite directions. The shafts are connected to each other at both ends by gears and each carries a flywheel at one end. By means of this arrangement the piston is always perfectly balanced, as the wrist-pins, revolved oppositely by the gears, are at all positions of the stroke equally distant from the center of the piston on opposite sides of the center line.

ROTARY VALVE.—JOSEPH BRADLEY STAGE, Talbot, Mich. The invention provides a rotary valve for the steam feed for sawmills so constructed as to automatically shut off the steam in case of a break in the connections that operate the valve. The valve core has a Y-shaped opening running through it from one side to the other. The top of the Y connects with the main inlet pipe and allows of the bottom part being shifted from one side to the other in order to send the steam through either of two ports to the cylinder. When the Y is in a vertical position, the bottom end is between the two ports, and the valve is closed. A weight is arranged on the shaft to bring the valve to this position in case the connecting rod that operates the valve becomes broken. Exhaust ports are also provided in the valve core.

Railway-Appliances.

ROLLING PLATFORM.—HENRY P. JOHNSON, Dillon, S. C. The invention consists in providing the platform of a freight house with a movable section for use in transferring freight with convenience and dispatch. The movable section is flush with the stationary platform and is arranged to move at a right angle to the edge of the latter out over one track, so that a car on the outer track can easily be unloaded.

Electrical Apparatus.

ELECTRIC MOTOR FOR BRAKES.—RICHARD A. J. EVANS, Chicago, Ill. The motor comprises field pieces extending upward from field magnets and connected at their top with a brass yoke and at their bottom with an iron one. The armature is placed between these field pieces and is mounted on a vertical shaft having bearings in the two yokes. A lever fastened on the end of the shaft projects backward a short distance and is kept in an open position by a horizontal spring pressing against the short end. The ends of the armature are curved slightly to fit around the field rods. When current is applied, they are attracted to these rods and move the lever horizontally.

Mechanical Tools.

SELF-FEEDING HAMMER.—CLARENCE H. CRAIG, Boulder, Col. The handle of the hammer contains a longitudinal slot into which the tacks or nails are inserted from the outside. By means of a simple spring arrangement they are fed one at a time into place before a small driving head, and held there till started into the wood by a single stroke, the springs which hold them in position then releasing them as the hammer is withdrawn. At the same time another nail is automatically slipped into place. The first nail is then driven in with the regular hammer head.

MAGAZINE TACK HAMMER.—LEWIS W. SAMMIS, 986 Manhattan Avenue, New York, N. Y. The hammer has a magazine containing tacks attached to the handle. A curved chute extends from the lower corner of the magazine to the tack-inserting head of the hammer. The tacks slide down this chute by gravity and are held between two spring clips while the first blow is given, after which the tack is freed from the hammer by pulling the latter bodily away from it.

Agricultural, Lumbering, and Mining Apparatus.

POTATO DIGGER.—MATHIAS G. BEAN, Rice Lake, Wis. This potato-digging machine is light and durable in construction. It is intended to be drawn by a team and can be operated by one person only if necessary. The digging fork is adjustable and may be set to enter the ground to any desired depth or adjusted at will. The potatoes, dirt, and vines are received upon the fork and separated at that point. The vines are carried to one side of the machine and there discharged, the dirt is sifted and returned to the ground, and the potatoes are raised on an endless belt elevator and fed into bags.

APPARATUS FOR TRANSFERRING SUGAR CANE.—AUGUSTUS BARBAY, Plaquemine, La. This apparatus was designed for the purpose of transferring bundles of sugar cane from the carts to the railway cars. It consists of a slightly inclined upright pole, having a cross-arm or sweep. The wagon containing the cane is driven under the sweep at its lower end and the bundle fastened to a rope or chain. A suitable lever arm is then run out from the base of the pole and fastened to the cart. The horses are driven around to the other side, thus turning the pole and sweep. Since the pole is inclined, the end of the sweep is raised higher on this side and thus the bundle of cane is brought to the level of the car.

RAKE ATTACHMENT FOR HARVESTERS.—JOHN PEGG, Bloomingport, Ind. The attachment is simple and durable in construction, effective in operation, and readily applied to a harvesting machine so as to work automatically. It is so arranged as to effectually carry the straw or clover from the front to the rear of the platform behind the cutter, and to drop it in bundles behind the latter. When not in use it is carried by one of the wheels of the harvester in a fore-and-aft position, parallel to the sides of the frame. It will, therefore, not wear to the usual extent, since it is in operation only when actually required.

SHOCK-BINDER.—GEORGE YOUNGS, Fayetteville, Mo. The binder consists of a single shaft or rod pointed at one end and having a T handle at the other. Two bent pins are fastened in the shaft at about the middle, to which the rope to be tautened is fastened. A second pointed shaft or prong runs parallel to the main one and has its top bent at right angles and fastened around it as a collar. A ratchet-wheel fastened to the main shaft just above this horizontal arm and a pin passing through just below it hold it in place on the shaft, while a pawl fastened to the arm engages the ratchet-wheel. A small thumb piece disengages the pawl from the ratchet when the shock is bound. All that is necessary to do this is to stick the two prongs in the bundle, fasten the cord to one of them, and turn the handle.

LOG-LOADING APPARATUS.—HORACE B. PHILLIPS, Halifax, N. C. This apparatus consists of a platform and framework on which is mounted a derrick, and a steam engine and boiler for operating it, as well as a pump or compressor for air or liquids. The platform is made to fit the top of an ordinary flat car and have its edges extend slightly over the sides of the latter. Near each of the four corners of the platform guideways are fastened to it and extend upward to the framework. Movable legs containing hydraulic rams which bear directly upon the platform slide in the guideways and permit of raising it so that the car can be withdrawn.

ORE PULVERIZER.—JAMES H. STEELE, Butte, Mon. The invention consists of a large drum having a cog gear around it adapted to be engaged by a small pinion, so that the drum will turn slowly. The drum contains three crushing rollers made up of solid disks, one edge of each of which is beveled. The rollers are arranged in such a manner that they are in peripheral contact with each other and with the sides of the drum. The material is fed through the shaft in the end of the drum (which is hollow), going in at one end and coming out at the other.

Miscellaneous Inventions.

TOY PARACHUTE.—JOAB Q. BROWN, Bethany, Mo. The parachute is hung from the point of an arrow or dart, so that when the latter is shot into the air, the parachute will be released at the end of the arrow's upward flight and descend slowly to the ground.

ANIMAL PEN OR TRAP.—JOSHUA D. FOX, Frankfort, Ind. The pen is constructed for the purpose of holding the head of an animal while it is being operated upon. It consists of a cage having two neck-holding parts, one of which is carried by the side of the pen, which is fulcrumed at its rear end to swing inward. An operating lever swings the side inward, and the lever is held at any desired point by a suitable locking bar.

ACETYLENE GENERATOR.—ROBERT L. DOHERTY, Palmyra, Mo. This generator is of the type in which the water falls upon the carbide. It has a gasogen in two parts, the upper one of which contains water and the lower one carbide. The walls of the upper compartment project downward some distance below the bottom and terminate in a water seal at the side of the lower compartment. Two cones, one inside the other, project downward from the bottom of the water compartment. The outer one has a small hole near its top part, and the inner a hole in its apex. A valve regulates the supply of water flowing into the cones and dropping from them on the carbide. A second valve in the end of a short pipe is connected with the gasometer bell and is opened when the bell falls in the usual manner. The gas generated passes through a cooling coil in the water chamber before entering the gasometer.

HOG-TRAP.—JOHN P. TARR, Augusta, Ill. The trap consists of a simple box with a drop door in each end. The doors are held open by catches connected by suitable levers with a slightly raised trap door in the bottom. When the animal enters and treads on the trap, the doors are released and fall by their own weight. Provision is also made for inserting a neck-holding frame in which to hold the animal's head while it is being operated upon.

PORTABLE CRADLE AND CARRIAGE.—MARK I. KNAPP, 280 Broome Street, New York. The invention provides an improved cradle and baby-carriage which can readily be taken apart and packed away in small space for storage or transportation purposes. The cradle is hung from each end on two uprights that are fastened to a suitably braced folding frame mounted on small wheels, so that it can easily be rolled about and used as a carriage as well as a cradle.

FORM FOR HULLS OF VESSELS.—MILLARD F. MITHOFF, New Orleans, La. The object of this inventor is to so form the hulls that they will be fully adapted to the action of the displaced water in their immediate vicinity when the vessel is under way, thus reducing to a minimum the resistance to the movement of the vessel. The inventor found by experiment that the waves made by the bow of a boat describe parabolic branches and the motion of the water caused by the stern is also in parabolic branches running in the opposite direction. Consequently he constructs the hull so that a horizontal section through it at the water-line or at any point below will show two parabolas facing each other and joining in a center section about a third of the way from the bow.

SCHOOL FURNITURE.—WILHELM H. METTING, Trenton, N. J. The invention consists in a new method of firmly fastening the wooden backs of school seats to the iron supporting framework. The backs are made of wooden slats with dovetailed grooves crossing them near each end. The iron supports have a rib of the same cross-section to fit into the grooves, but this rib is formed of two parts, one of which is cast with the support, the other being separate. A semicircular groove runs in the face of each of them, and after the slat has been slipped on, a flexible rod is driven through the hole, thus firmly fastening the slat in place.

COPY-HOLDER.—LOUIS HUDGIN, Lochiel, Arizona. This holder is intended to be fastened to a typewriter desk for the purpose of holding the copy in an inclined position over the machine and directly in front of the eyes of the operator. It consists of a rectangular vertical support frame hinged to foot pieces which are fastened to the desk, and having two pairs of hinged arms projecting out at an angle from its front face, one pair being at the center of the frame and the second or shorter pair projecting from the top. These arms carry the copy-holder, which is a frame having spaced rods. The holder may be adjusted by raising or lowering the longer pair of arms, which are held by a ribbon.

PROCESS OF RENDERING WRITING INERADICABLE.—STANLEY J. MORROW, Peoria, Ill. This process consists in writing on specially prepared asbestos paper with an acid ink, and then carbonizing the writing by means of heat. The asbestos fibers in the paper prevent it from falling apart in the places where the writing occurs.

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DEVICE FOR ATTACHING HOOKS, ETC., TO STRAPS.—HERMAN D. DETERT, Faribault, Minn. The device consists of a box casing designed to receive a strap having a longitudinal slot down the center of one side and several holes in the center of the other. A metal tongue with pegs on it a proper distance apart is placed beside the strap with its pegs through the holes in the latter, and the tongue and strap are then slipped into the receiving box. The tongue is grooved on the sides in order to be held firmly on the slotted side of the box, and its pegs project through into the holes on the opposite side, thus holding the strap securely. A hook is fastened to the box piece so as to fasten it to the breast collar.

PENHOLDER.—WILLIAM THURMAN, Denton, Tex. The penholder consists of a hollow barrel with a telescopic upper end formed of two telescopic sections, the larger one of which contains a spring placed between the end of the smaller section and the end of a plunger movable in the main barrel and carrying the pen in its lower end. By this arrangement freedom of movement to the thumb and fingers is secured, and cramping of the hand is avoided.

NAIL.—BERNHARD SCHNITZLER, 10 to 14 Bleecker Street, New York, N. Y. The invention is a T-shaped lath nail, in which the head of the T is about half the length of the shank and slightly curved, so that if the nail is driven in at an angle, there will be no sharp corners of the head projecting.

FISH-SCREEN FOR ARTIFICIAL WATERWAYS.—GEORGE D. BIRD, Gunnison, Col. A cylinder covered with wire gauze is placed across the flume and is turned by a paddle wheel to which it is connected by a chain. A board is fastened to the bottom of the flume with its upper edge fitting tightly against the cylinder, so that fish are stopped from going any farther, while leaves or debris are carried over by the revolving cylinder.

PNEUMATIC PROPULSION MEANS.—JAMES C. WALKER, White Cliff Springs, Tenn. The propeller shaft is made hollow to be used as an air tube. The jet of air passes through the propeller shaft, and the air thus discharged will fill any space which may be created directly at the rear of the propeller blades.

STORAGE BATTERY.—CHARLES and HARRY LINDENBERGER and WILLIAM B. TEAL, care Lindenberger, Teal & Co., 354 Century Building, St. Louis, Mo. The invention consists of an improved battery cell or box made of hard rubber. A perforated partition is placed inside the cell, which is a low, flat box, and a small space is left between the partition and walls of the cell in which to place the electrolyte. The active material is placed inside the center space in the form of blocks which are pressed into contact with lead plates extending along the top and bottom of the cell. The blocks which form the positive and negative plates are separated by a layer of charcoal wrapped in asbestos paper. The ease with which these blocks can be renewed constitutes the main feature of the battery.

THREAD CUTTER.—BERT NEWSOME, Minonk, Ill. This device consists of a circular spring ring to slip over the finger. Pivoted in trunnions on one end of the ring is a short cutter blade which is sprung outward by a slight pressure of the finger in order to be used for cutting thread.

Designs.

DESIGN FOR A SAW-BLADE.—DOUGALD MCEACHERN, Erie, Canada. The teeth of the blade are very nearly the shape of a boot with a sloping leg portion, and the alternate teeth are tapered on their opposite sides, gradually becoming thinner near their rear ends.

DESIGN FOR A BUFFER-SPRING.—ZERAH H. TATE, Erlanger, Ky. The shape of the spring resembles somewhat a pair of tongs, one prong being bent outward and then parallel with the other and having a rectangular plate fastened to it at the end and the other being slightly curved and having a hole near its outer end.

DESIGN FOR A TICKET BLANK.—FERDINAND KRONENBERGER, 1147 Tinton Avenue, New York, N. Y. The design consists of a rectangular blank having perforated lines extending diagonally across its four corners. The four rows of perforations practically form a square, and arranged within this square is an outline rectangular panel, in the center of which is a circular row of perforations.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

ENGINE ROOM PRACTICE. A Hand Book for Young Marine Engineers. By John G. Liversidge, Chief Engineer R. N. London: Charles Griffin & Company. Philadelphia: J. B. Lippincott Company. 1899. Pp. 292. 12mo. Price $2.50.

The volume before us impresses us as being a really practical book on marine steam engineering. It is filled with valuable information and hints which will probably not come amiss to even the engineer who has actual charge of a marine engine. The diagrams are most of them clear and significant. The tables are also valuable. Although the book is written by an Englishman and is devoted to English practice, at the same time marine engineering is very much the same in vessels of all nationalities.

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(7709) P. H. L. writes: A trolley car is running on wire notches and the overhead wire becomes he negative and the track positive; what result to the car or motors? I claim the car will run ahead as before. The other gentleman claims it will reverse and run backward. By deciding this argument you will greatly oblige. A. Reversing the current on the line has no effect on the motor. To reverse the motor, the current must be reversed either in the armature or in the field magnet, but not in both. The motorman does this when he backs the car.

(7710) W. B. writes: At what longitudinal point does Sunday begin? A. Sunday like all the days of the week begins at midnight following the preceding day, at the meridian of 180 degrees east or west of the meridian of Greenwich, England. The line is in the Pacific Ocean, running from Behring Straits west of the Aleutian Islands and the Hawaiian group and east from New Zealand.

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Door hanger and track, R. Oliver 630,733
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Drill. See Disk drill. Pneumatic drill.
Dropper. See Seed dropper.
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Pneumatic propulsion means, J. C. Walker 630,821
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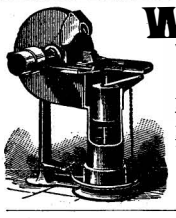

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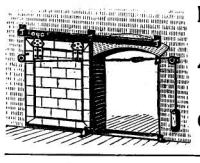

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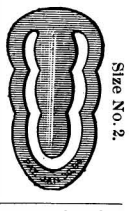

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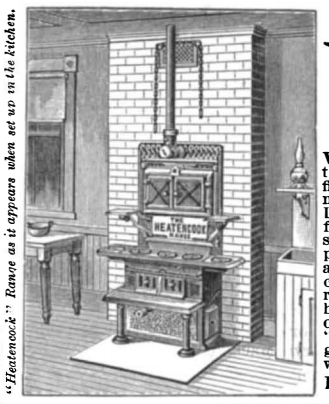

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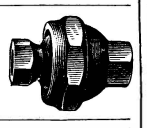

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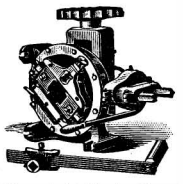

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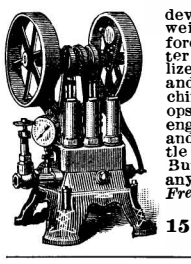

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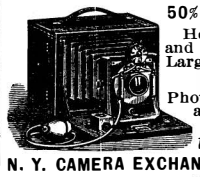

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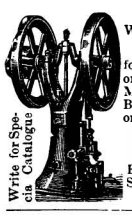

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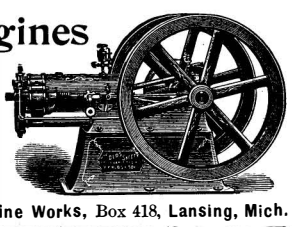

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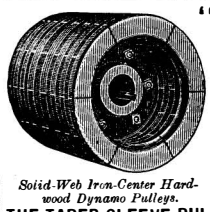

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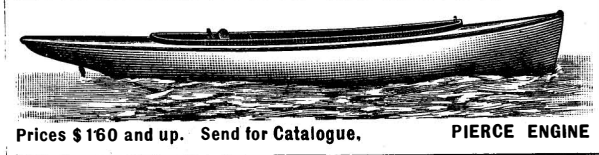

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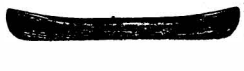

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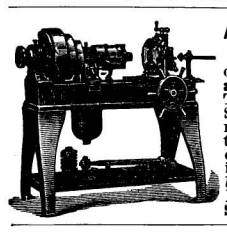

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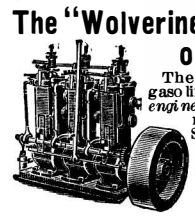

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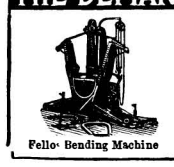
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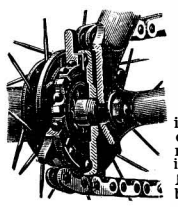

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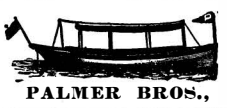

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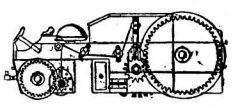

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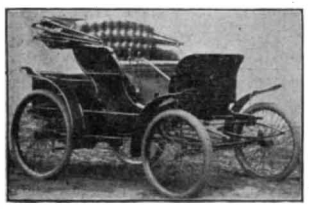

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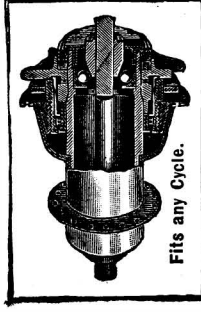

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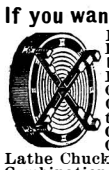

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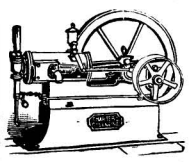

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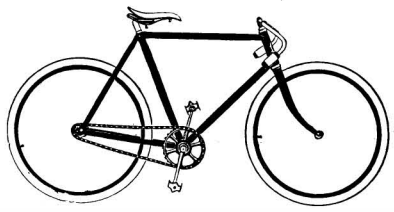

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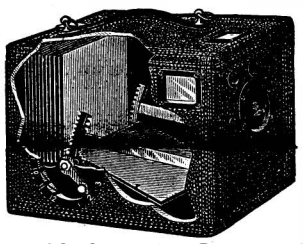

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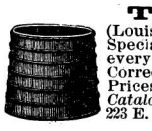

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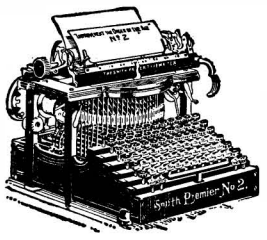

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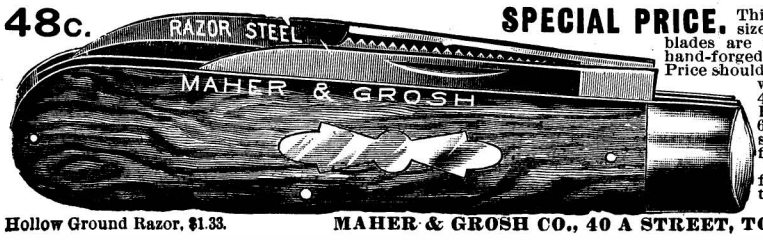

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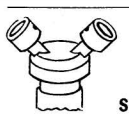

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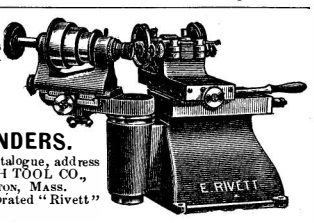

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